

**UNIVERSITY OF VAASA  
FACULTY OF TECHNOLOGY  
INDUSTRIAL MANAGEMENT**

Sara Tilabi

**INVESTIGATING THE BUSINESS STRATEGY OF SMALL AND MEDIUM SIZE  
COMPANIES IN FINLAND  
By Sustainable Competitive Advantages Methodology**

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Table of Content:	page
SYMBOLS AND TERMS.....	3
LIST OF FIGURES.....	5
LIST OF TABLES.....	9
ABSTRACT.....	11
1. INTRODUCTION.....	12
2. LITERATURE REVIEW.....	14
2.1.Theory background.....	14
2.1.1. Manufacture strategy.....	14
2.1.2. Sustainable competitive advantages (SCA).....	16
2.1.3. Resource based view of a firm.....	19
2.1.4. Core competence model.....	21
2.1.5. Knowledge and technology as a key to SCA .....	21
2.2. Methods and calculation to implement SCA.....	23
2.2.1. Sense and responds (S&R) vs. make and sell.....	23
2.2.2. The analytical hierarchy process (AHP).....	24
2.2.3. Critical factor index/ balanced critical factor index.....	25
2.2.4. Methods of judgments for critical attributes .....	28
2.2.5. RAL model.....	29
2.2.6. The questionnaire and assigning the attributes for RAL model.....	30
2.2.7. Technology IMPL.....	31
2.2.8. Manufacture strategy index.....	32

3. METHODOLOGY OF THE RESEARCH.....	35
3.1.Method.....	35
3.2. Case introduction, Oulu South Region of Finland.....	36
4. EMPIRICAL RESEARCH.....	37
4.1. Case company A.....	37
4.2.Case company B.....	44
4.3.Case company C.....	52
4.4.Case company D.....	59
4.5.Case company E.....	65
4.6.Case company F.....	72
4.7.Case company G.....	78
5. DISCUSSION.....	86
6. CONCOLUSION.....	90
LIST OF REFERENCES.....	91

## SYMBOLS AND TERMS

<b>A</b>	Analyzer
<b>AHP</b>	Analytic Hierarchy Process
<b>BCFI</b>	Balanced Critical Factor Index
<b>CFI</b>	Critical Factor index
<b>C</b>	Cost
<b>D</b>	Defender
<b>F</b>	Flexibility
<b>IMPL</b>	Implementation
<b>MAD</b>	Maximum Deviations
<b>MAPE</b>	Absolute Percentage Error
<b>MSI</b>	Manufacturing Strategy Index
<b>OP</b>	Operational Performance
<b>OEI</b>	Oulu south region of Finland
<b>P</b>	Prospector
<b>RAL</b>	Responsiveness Agility Leanness Model, which unites four key parameters affecting the business performance – Quality, Cost, Time and Flexibility (Takala 2007).
<b>RBV</b>	Resource-Based View

<b>RMSE</b>	Root Means Squared Error
<b>S&amp;R</b>	Sense and Respond
<b>SME</b>	Small and medium size enterprise
<b>SCA</b>	Sustainable Competitive Advantage
<b>SCFI</b>	Scaled Critical Factor Index
<b>SD</b>	Standard Deviation
<b>T/K</b>	Technology and Knowledge
<b>Q</b>	Quality

## LIST OF FIGURES

Page

Figure 1. The industrial/ Organizational (I/O) model.....	18
Figure2. The resource view of the firm(RBV).....	18
Figure3. Core competence model.....	19
Figure4. The linkage between technology life cycle and technology pyramid.....	22
Figure5. Example of the final bar charts to represents CFI, BCFI and SCFI results.....	28
Figure6. RAL model.....	30
Figure7. Presentations of extreme attributes for company (Past strategy)- Company A....	37
Figure8. Presentations of extreme attributes for company (Future strategy)- Company A..	38
Figure9. Comparison between Expectations and Experience for company A.....	39
Figure10. Competitive priorities in past-company A.....	40
Figure11. Competitive priorities in future-company A.....	40
Figure12. PDA values in past-company A.....	41
Figure13. PDA values in future-company A.....	42
Figure14. BCFI and BCFI T/K-company A.....	42
Figure15. Presentations of extreme attributes for company (Past strategy)- Company B...	45
Figure16. Presentations of extreme attributes for company (Future strategy)- Company ..	45
Figure17. Comparison between Expectations and Experience for company B.....	47

Figure18. Competitive priorities in past-company B.....	47
Figure19. Competitive priorities in future-company B.....	48
Figure20. PDA values in past-company B.....	49
Figure21. PDA values in future-company B.....	49
Figure22. BCFI and BCFI T/K-company B.....	50
Figure23. Presentations of extreme attributes for company (Past strategy)- Company C...53	
Figure24. Presentations of extreme attributes for company (Future strategy)- CompanyC.54	
Figure25. Comparison between Expectations and Experience for company C.....	55
Figure26. Competitive priorities in past-company C.....	55
Figure27. Competitive priorities in future-company C.....	56
Figure28. PDA values in past-company C.....	57
Figure29. PDA values in future-company C.....	59
Figure30. Presentations of extreme attributes for company (Past strategy)- Company D...58	
Figure31. Presentations of extreme attributes for company (Future strategy)- CompanyD.60	
Figure32. Comparison between Expectations and Experience for company D.....	61
Figure33. Competitive priorities in past-company D.....	62
Figure34. Competitive priorities in future-company D.....	62
Figure35. PDA values in past-company D.....	63
Figure36. PDA values in future-company D.....	63
Figure37. BCFI and BCFI T/K-company D.....	64

Figure38. Presentations of extreme attributes for company (Past strategy)- Company E...	66
Figure39. Presentations of extreme attributes for company (Future strategy)-Company E.	67
Figure40. Comparison between Expectations and Experience for company E.....	68
Figure41. Competitive priorities in past-company E.....	68
Figure42. Competitive priorities in future-company E.....	69
Figure43. PDA values in past-company E.....	74
Figure44. PDA values in future-company E.....	74
Figure45. BCFI and BCFI T/K-company E.....	71
Figure46. Presentations of extreme attributes for company (Past strategy)- Company F...	73
Figure47. Presentations of extreme attributes for company (Future strategy)- Company F.	73
Figure48. Comparison between Expectations and Experience for company F.....	74
Figure49. Competitive priorities in past-company F.....	75
Figure50. Competitive priorities in future-company F.....	75
Figure51. PDA values in past-company F.....	76
Figure52. PDA values in future-company F.....	76
Figure53. BCFI and BCFI T/K-company F.....	77
Figure54. Presentations of extreme attributes for company (Past strategy)- Company G...	79
Figure55. Presentations of extreme attributes for company (Future strategy)- Company G.	80
Figure56. Comparison between Expectations and Experience for company G.....	81
Figure57. Competitive priorities in past-company G.....	81



Figure58. Competitive priorities in future-company G.....	82
Figure59. PDA values in past-company G.....	83
Figure60. PDA values in future-company G.....	83
Figure61. BCFI and BCFI T/K-company G.....	84
Figure62. Competitive priorities in past.....	87
Figure63. Competitive priorities in future.....	87
Figure64. SCA risk classification in past.....	88
Figure65. SCA risk classification in future.....	88

LIST OF TABLES	Page
Table1. Strategy type.....	16
Table2. Make and Sell vs. Sense and Respond.....	23
Table3. Format of questionnaire.....	24
Table4. AHP competitive priorities .....	25
Table5. CFIs calculation formula.....	26
Table6. Visual representation of the attributes divided between the RAL model elements.....	30
Table7. SCA risk level (Past)-Company A.....	43
Table8. SCA risk level (Future)-Company A.....	43
Table9. SCA risk level (Past)-Company B.....	51
Table10. SCA risk level (Future)-Company B.....	51
Table11. SCA risk level (Past)-Company C.....	58
Table12. SCA risk level (Future)-Company C.....	58
Table13. SCA risk level (Past)-Company D.....	64
Table14. SCA risk level (Future)-Company D.....	65
Table15. SCA risk level (Past)-Company E.....	71
Table16. SCA risk level (Future)-Company E.....	72
Table17. SCA risk level (Past)-Company F.....	78

Table18. SCA risk level (Future)-Company F.....	78
Table19. SCA risk level (Past)-Company G.....	84
Table20. SCA risk level (Future)-Company C.....	85

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**UNIVERSITY OF VAASA****Faculty of Technology:**

<b>Author:</b>	Sara Tilabi
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**ABSTRACT:**

This research focuses on small and medium size enterprises (SMEs) in Oulu south region of Finland (OEI) which intend to enter to global market. This paper concentrates on operative competitive advantage and applies a method to measure risk and opportunities towards one specific business strategy regarding firms' internal resource allocation. Moreover, this research tries to evaluate the effect of knowledge and technology (K/T) factor towards supporting company strategy. The research is based on investigation of 7 case studies from Oulu region of Finland (OEI) via interview. The interview is carried out with phone or during face to face meeting. Moreover Sense and Respond (S&R) questionnaire form are filled by the respondents and are returned via Email.

The results from this paper show that *sustainable competitive advantages* method is applicable well in small *and medium size company* in Finland. Also the results show that SME's company in Finland mainly act as analyzer and focus on time and cost at the same time. Finally, the research shows technology and knowledge factor effect on SCA results but not to a fixed direction.

As the limitation of this paper, calculation of CFI factors for one case company which is investigated by one interview is not possible. Besides, as number of respondents of each case company is small, so it is not possible to eliminate the effect of standard deviation in calculation of CFIs factor.

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**Key Words:** Sustainable competitive advantage (SCA) model, Sense and response (S&R) methodology, Knowledge and technology (K/T), Risk level, Small and medium sized enterprise (SME), Oulu south region of Finland (OEI)

## 1. INTRODUCTION

Turbulent environments in business world changes static sustainable competitive advantages to a dynamic notion. According to Si, Takala and Liu (2010) “The future competitiveness of manufacturing operations under dynamic and complex business situations relies on forward-thinking strategies”. It shows that companies should have multifocused strategy which enable them to consider competitive priorities such as time, cost, quality and flexibility at the same time. Obviously such a comprehensive approach provides companies to understand the business completely and react more carefully. The final consequence of this approach is not only to remains in business but also to develop it and make it more profitable.

Since 1995 that *sustainable competitive advantages* (SCA) was introduced by Porter for the first time, this notion has evolved continuously in such a way Barney (1991) completed it as “A firm is said to have a sustained competitive advantage when it is implementing a value creating strategy and when other firms are unable to duplicate the benefits of this strategy”. Then in 2001, Barney introduces SCA method as a resource based theory with the goal of keeping balance in existing resources of the firm to utilize them towards creating advantages. Because, *resource based view* (RBV) philosophy believes that the critical factors for success exist in the firm itself in terms of its resources and capabilities.

This research focuses on investigation of SME’s companies in Finland via SCA method. The goal is to evaluate SCA method applicability. This research, attempts to answer five research questions:

- 1.To what extend SCA method is applicable in SME’s companies in OEI region?
2. What are competitive priorities of SME’s companies in OEI region?
3. Whether the strategy of SME’s companies in OEI region is sustainable?

4. What is the evaluation of SCA risk level of SME's companies in OEI region?

5. What is the effect of K/T factor on SCA values?

In order to answer research questions seven SME's case companies from Oulu region of Finland are investigated via interview. The interview was conducted via phone or during face to face meeting. Moreover in order to validate the results, second interview are conducted. This second interview which is named Weak Market Test (WMT) is conducted via presenting obtained results from the method to the managers and evaluate how much these results present the company real situation.

As practical implications, this research helps to have better understanding of SME's companies in Finland and also provides companies with the tools to resource allocation regarding the companies' final strategy. Moreover, this paper makes a basic bridge towards evaluating *knowledge and technology* (K/T) effect on CFIs analysis.

The structure of the research is as: first part presents theory background about the topic, second part introduces tools and method which are used to implements SCA method, third part is introduction of the cases. Then the results are presented and finally research questions are answered and conclusion comes.

## 2. LITERATURE REVIEW

This chapter covers theoretical aspects and methods which are used for conducting this research. The goal of this chapter is to provide readers sufficient information that enables them to have better understanding towards this research, its's questions and discussion.

The chapter is divided to two parts. First part covers relevant information about sustainable competitive advantages and second part explains methods and formula to implement sustainable competitive advantages.

### 2.1.Theory Background

#### 2.1.1. Manufacturing Strategy

Strategy which can be defined as “the pattern or plan that integrates an organization’s major goals, policies and action sequences into a cohesive whole” (Quinn 1980), has a close relation with the company resources allocation. Proper resource allocation will enable companies to have a good reaction in front of changes in environments and business. Nowadays the concept of business strategy is even more and includes new models of leadership and a corporate social responsibility (Grant 2005).

There are different types of strategy topology which managers and decision makers implement in a business. Some of them are:

**Igor Ansoff’s topology:** this kind of typology is based on two variables: market and product. Considering these two variables, this typology has 4 main strategies: 1.*Market penetration* that concentrates on increasing existing products in the actual market, 2.*Product development* which tries to introduce new products in the current market, 3.*Market development* which attempts to position existing products in new markets and

4. *Diversifying* which creates new products for new markets. This typology does not consider external factors hence it is fit to basic strategy development processes or an overall strategy categorization (Ansoff 1965).

**Michael Porter's topology:** which is also famous as *General Strategy* prioritizes the competitive advantage and defines company strategy on the basis of three category: *Cost leadership*, *Differentiation* and *Segmentations*. In cost leadership strategy, company focuses on lowest price which can be results of optimize processes, standardized products and of the resources. Differentiation strategy focuses on superior products or services which are results of better quality, product customization, adding product features or customer services. Finally the segmentations strategy attempts to segment of costumers or geography territory and then fulfill unique needs of that special segment (Porter 1980).

**Miles and snow topology:** this topology classifies business strategy in four groups: *Prospector*, *Analyzer*, *Defender* and *Reactor*. According to Miles and snow topology, managers adopt one of these classes to react in front of external environment (Daft 2009).

*Prospector strategy:* this kind of strategy tries to lead it's industry. The main focus of this category is quality. Prospectors innovate in processes and take risk. Moreover, they bring new opportunities to the market.

*Defender strategy:* This strategy focus on a mature product or market operation. Defenders concentrate on efficiency and process improvement and prefer not to take risks; they strengthen efficiency and maintain their current costumers.

*Analyzer strategy:* tries to remains in a steady state in market but at the same time provide change and innovation. Analyzer is placed between the defender and prospector strategy.

*Reactor strategy:* is no-strategy and happens in absence of defined goals and objectives. In this type of strategy, there is no sense of direction and decisions are taken to respond immediate problems. Hence this type of strategy is not considered as a separate category.

The choice between these alternatives depends on the current product life cycle and managements' interpretation of the external environment. Mainly companies have three types of problem: Entrepreneurial, engineering, and administrative problems (Daft 1986: 480-481).



Differences between these four strategies type are listed in the table below:

**Table 1.**Strategy types: (Daft 1986: 481, Miles, Snow, Meyer & Coleman Jr., 1978: 557-558).

<b>Characteristic</b>	<b>Defender</b>	<b>Analyzer</b>	<b>Prospector</b>	<b>Reactor</b>
<b>Environment</b>	Stable	Moderately Changing	Dynamic, Growing	Any condition
<b>Strategy</b>	Seal Off share of market Protect tuff. Advertise to hold customer	Maintain market but innovative at edges. Locate opportunities for expansion while protecting current position	Find and exploit new market opportunities. Scan environments. Take risk.	Not clear strategy . React to specific condition. Drift.
<b>Internal characteristic</b>	Efficient production. Retrench tough control. Centralized mechanistic	Efficient production yet flexibility for new lines. Tight control over current activities. Looser for new lines.	Flexible production. Innovation and coordination. Expansion. Centralized organic.	Now clear organization approach. Depends on current needs.

### 2.1.2. Sustainable Competitive Advantages

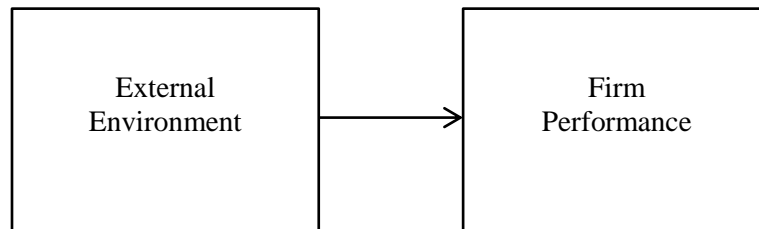
Nowadays, Static competitive environment has been replaced by an increasingly dynamic uncertain environment. These turbulent environments cause to rapid technological change and constantly shortening product life cycle. Therefore the notion static complete advantage is replaced by sustainable complete advantages-SCA (Weihong, Caitao, Aiqiang 2008). In today's business world, the main goal of establishing a business is to

obtain sustained competitive advantage rather than a temporary competitive advantage (Besanko 1999).

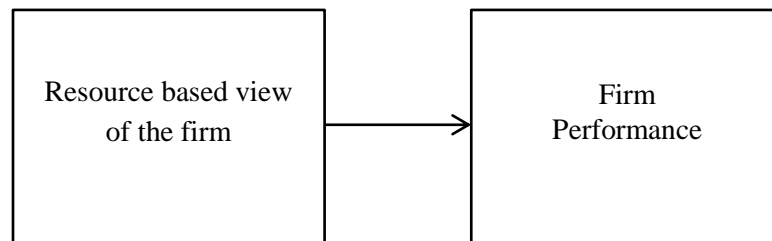
Ansoff (1965) mentioned that for the first time in 1960's, SWTO (strength, weakness, opportunity, threat) frame work has been used as a single organizing frame work to SCA research. The idea behind of SWTO frame work is to obtain SCA by implementing strategies that increase the internal strengths while decrease internal weaknesses through responding to environmental opportunities and avoiding risk. The main problem of this frame work is to focus on the impact of a firm's environment and does not consider firms' unique structure. Hence in 1990, Porter proposes a positioning theory based on a generic strategy. This generic strategy is based on *Overall cost leader ship*, *Differentiation* and *Segmentation*. However there is still so many criticize about positioning theory such as: 1.it considers a firm as a "black box" and is not able to explain why there is difference in firm's performance while they choose the same strategy in the same market and industry (Jensen 1998), 2.This generic model is an ideal type so it is difficult to operate somehow in a real business because it considers that firms performance is only a deviation of a single generic strategy (Miller 1992), 3.Positioning strategy is not applicable in today's business world as the nature of business and world is incredibly dynamic and turbulent (Porter 1996).

Over one decade, finding a way to obtain and keep sustainable competitive advantages was the head line of topic for researchers and scholars. Nowadays, there are three perspectives of the modern strategy theory: the I/O model, the resource-based view and core competence-based view. In I/O model, external factors play key role and impose the firm to implement one strategy. The assumption of this model is that most firms have similar strategic resources and competitiveness can only be increased when a firm finds an industry with the most profit potential. Later on, the firm should know how to use its current resources to implement the strategy considering the structural attributes of that industry. On opposite of I/O model, there is resource based view of the firm that assume that the critical factors for success exist in the firm itself in terms of its resources and capabilities. The goal of this model is to keep balance in existing firm resources to utilize them towards creating advantages. Third perspective which is core competence-based view emerges I/O model

and resource based view of the firms and believes in concept of core competence which is defined as collective learning in the organization specially how to integrate multiple stream of technology and coordinate diverse production skills (Zhong-hai, Bo, Hong 2008). The following pictures show the difference between these three perspectives:



**Figure1.**The Industrial/Organizational (I/O)



**Figure2.**The Resource-Based View (RBV)



strategy depend on their resources. In other words, if a firm has advantages in something, should use it (Wernerfelt 1984).

One of the easiest applications of RBV is to look at the level of business unit strategy. it means if the firms participate in a specific industry, how should compete? The answer is if a firm faces lower variable cost or produces higher quality products than others then it can often increase profitability by positioning its products. Another application of RBV theory is to answer this question: In which industries should the firm participate? The answer is: it should participate in industries which its resources are important (Wernerfelt 1984).

As the resources are different in excess capacity, Wernerfelt makes category for them according to their long and short term capacity: 1. Resources with fixed capacity such as physical assets which rarely play a role to expand a firm scope, 2. Resources with unlimited capacity such as brand name and reputations and 3. Resources with fixed short term but unlimited long-term capacity like corporate culture and a firm's learning curve.

Another question related to RBV is that: over long period of time, under which circumstances will a resource causes to high returns?

In order to answer this question Porter's five competitive forces (Porter 1980) is used although this model normally is used to analysis the product (Wernerfelt 1984).

- General effects: means the bargaining power of supplier and byer in market. In input side, if the resource of one production is controlled by a monopolistic group it will diminish the returns available to the user of the resource. In the output side if the product resulting from use of the resource can be sold only to monopolistic market so the supplier can earn less money in comparison with the situation there is so many customers.
- Resource position barriers: is the condition that contents the mechanism which makes an advantage over another resource holder defensible.

- Attractive resources: means long and short term capacity of recourse. In this part some resources such as machine capacity, customer loyalty, production experience, and technological leads should be taken to consideration.
- Mergers and acquisitions: provides an opportunity to trade. Non marketable resources are sold in bundles.

#### 2.1.4. Core Competence Model

In Core competence model two factors play role in firm performance: external and internal environments. In this model there are two constructs of competences: functional such as local technologies, abilities and knowledge and integrative competences which allow the firms to supply, distribute and integrate information from different sources inside and outside the firms including facilities to coordinate and cooperate within the firms.

#### 2.1.5. Knowledge and Technology as a Key to Sustainable Competitive Advantages

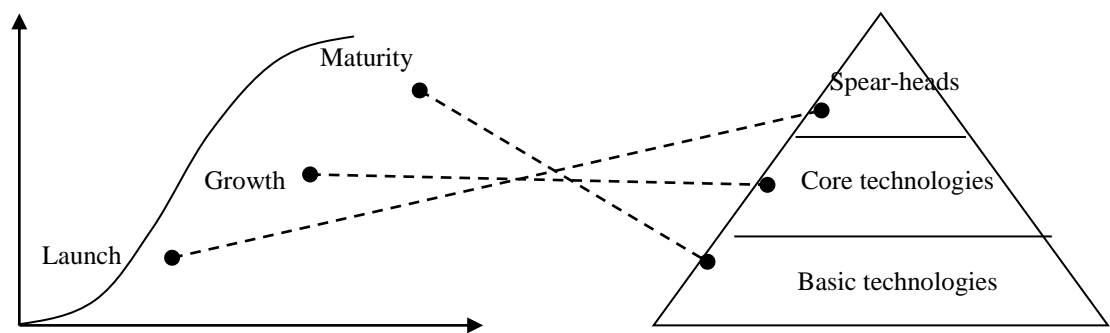
Lubit (2001) believes sustainable competitive advantages is mainly based on knowledge, means that knowing how to do things is more important than having special access to resources. Regarding to what mentioned above, knowledge and intellectual capital are both the bases of core competencies and the important key to high performance.

However, it is not easy to develop a sustainable core competence based on knowledge. Toward this goal, it is essential to spread knowledge within the firm and avoid from spread to other firms (Lubit 2001).

Marone (1989) writes about the important role of knowledge and technology factor on SCA and mentions that decision makers should consider knowledge and technology factor effect in setting strategy because it provides the opportunity of competitive advantage.

In order to apply knowledge and technology effect to Sense and Respond (S&R) method respondents are required to evaluate each attribute in terms of basic, core and spearhead technologies in percentages while keeping the summation of these three terms to 100%.

Different types of technology are defined depends on which stage a technology is in its life cycle. According to Tuominen, Knuuttila, Takala & Kekäle (2003) there are three different types of technologies: Basic (Key) technology. Core and spearhead technology. The following picture shows these three types of technology also presents the connection to the technology life cycle.



**Figure4.** The linkage between technology life cycle and technology pyramid (Tuominen et al 2003: 5).

Basic technology is referring to the technology that is the most critical for the business. Mainly the products and services are based on this technology and therefore are the foundation of the business. To prevent the business of leaking to competitors these kind of technologies are kept inside the company. Core technologies include technologies that bring competitive advantages to competitors and enable the company to grow. And spearhead technology focuses mainly on future and is the most potential and brings successful business opportunities in future (Takala 2012).

## 2.2.Methods and Calculation to Implement SCA

### 2.2.1. Sense and Respond (S&R) versus Make and Sell

Companies are moving from their traditional “make and sell” strategies toward “sense and respond” strategies that are faster and offer more real time information (Nolan and Bradley 1998).this means that the traditional way of planning production based on the manufacturers has been replaced by anticipation of the customers’ need in real time. The key differences between “make and sell” strategies compared to “sense and respond” strategies are (Bradley & Nolan 1998: 6):

**Table 2.** Make and Sell vs. Sense and Respond

Make and Sell	Sense and Respond
Annual budget resource allocation is the "heartbeat"	Dynamic, real time resource allocation is the "heartbeat"
Glacial change	Real-time change
Design, build, sell	Sell, build, design
Plan	Act
Market share	Mind share
Build to inventory	Build to customer
Build reliable, complex products and services	Create unimaginably complex products and services

Sense and respond strategy is used to assist in forming a picture of what might happen in the future. Using sense and respond method enables firms not only to collect data



regarding expectations and experiences but also to understand how firms see themselves compared to competitors. Besides, firms are able to see the development of a certain attribute at a given time frame (Strauss and Neuhauss 1997; Bradley and Nolan 1998; Ranta and Takala 2007). The following tables shows model of questionnaire for Sense and Respond method (Takala & Ranta 2007):

**Table3.** Format of the questionnaire (adapted from Ranta & Takala 2007).

Performance attribute	Scale: 1=low, 10=high		Compared with competitors			Direction of development		
	Expectation (1-1)	Experience (1-10)	worse	same	better	worse	same	better
Performance 1								
Performance 2								

Five key points of the benefits of using sense and respond are (Nolan & Bradley 1988):

- gaining high levels of financial results
- obtaining high levels of innovation
- Reducing cycle-time for developing high complex products
- Providing challenging work for knowledge workers
- Efficiently delivering value to customers

Sensing in advance and responding more suitable to what is occurred requires a fundamentally different decision-making which supports sense and respond model, therefore Critical Factor Index (CFI) methodology will be explained in the following part (Nadler & Takala 2008).

### 2.2.2. The Analytic Hierarchy Process (AHP)

”The Analytic Hierarchy Process (AHP) method is a multi-attribute decision instrument that allows considering quantitative, qualitative measures and making tradeoffs”(Saaty 1980).

AHP method which is based on pairwise comparison between criteria was introduced to apply for mathematics and psychology for the first time but nowadays this method is used to make decisions in business, industry, health care, education and even government.

In order to apply AHP method in strategic decision making, four main criteria are defined: (quality, cost, time and flexibility), the next step is to use the sub-criteria related to the main criteria.

**Table 4.AHP Competitive Priorities ( Saaty 2008).**

Goal	COMPETITIVE PRIORITIES OF MANUFACTURING STRATEGY												
Criteria	Quality			Cost			Time			Flexibility			
Sub-Criteria	Environmental Aspects			Low Cost			Fast Delivery			Broad Product Line			
										Mix Changes			
										Volume Change			
										Design Adjustment			
										Dependable Promises			
										Right Quality			
										Right Amount			
Sub-Criteria	Product Performance			Value Added			On Agreed Time			Continuous Improvement			
										Activity Based Measurement			
										Quality Costs			
										Fast Delivery			
										On Agreed Time			
										Right Amount			
										Right Quality			
Sub-Criteria	Low Defect Rate			Certification			Continuous Improvement			Activity Based Measurement			
										Quality Costs			
										Value Added			
										Low Cost			
										Fast Delivery			
										On Agreed Time			
										Right Amount			

In order to implement AHP method two main steps are conducted: firstly, participants are given two different criteria which effect on manufacturing decision making then they choose which of them is more important. Next step is to give a weight from 1-9 to the chosen factor in order to indicate to what extent selected factor is more important than the other one. In case of choosing 1 it means both factors are equal in terms of importance.

### 2.2.3. Critical Factor Index/ Balanced Critical Factor Index

“The Critical Factor Index (CFI) method is a measurement tool to indicate which attribute of a business process is critical and which is not, based on the experience and expectations

of the company's employees, customers or business partners" (Ranta & Takala 2007). In fact, the CFI method is a supporting tool for the strategic decision-making. This tool helps managers to make decision fast and react more suitable. In the current business environment fast adaptation and development can be considered as one of the most important strengths (Takala & Uusitalo 2012).

Balanced Critical Factor Index (BCFI), that is modified CFI, detects the most critical factors affecting the overall company's performance much more properly and reliably. BCFI method provides the company with the crucial strategic data for the approach development and correction. The easiest way for the required data collection is the qualitative questionnaire. The key issue is that the more interviews take place in the data collection phase, the results are more reliable.

The SCFI model is developed by Takala et al. (2011) which adds trend research into the study (Liu 2010).

After the data collection, the following formulas are used to calculate CFI, BCFI and SCFI (Nadler & Takala 2008 ; Takala & Uusitalo 2012):

**Table 5.** CFIs calculation formula

Name	Model
CFI	$CFI = \frac{Std(experience) * Std(expectations)}{Gap\ Index * Direction\ of\ Development\ Index * Importance\ Index} \quad (1)$
BCFI	$BCFI = \frac{Std(experience) * Std(expectations) * Performance\ Index}{Importance\ Index * Gap\ Index * Direction\ of\ Development\ Index} \quad (2)$
SCFI	$SCFI = \frac{\sqrt{\frac{1}{n} \sum_{i=1}^n [experience(i) - 1]^2} * \sqrt{\frac{1}{n} \sum_{i=1}^n [expectations(i) - 10]^2} * Performance\ Index}{Importance\ Index * Gap\ Index * Direction\ of\ Development\ Index} \quad (3)$

Parameters:

- Importance index: presents the level of importance of one criteria among others. this index reflects the actual expectations of the company regarding one criteria.

$$Importance\ index = \frac{Avg(experience)}{10}$$

- Gap Index: which is used to understand the gap between experience and expectations of a specific criteria

$$Gap\ index = \left| \frac{Avg(experience) - Avg(expectation)}{10} - 1 \right|$$

- Development index: This presents the information about the actual direction of the company's development.

$$Developments\ index = \left| \frac{Better\% - Worse\%}{100} - 1 \right|$$

- Performance index: presents the value of an attribute's performance based on the real experience of the respondents

$$Performance\ index = \frac{Avg(experience)}{10}$$

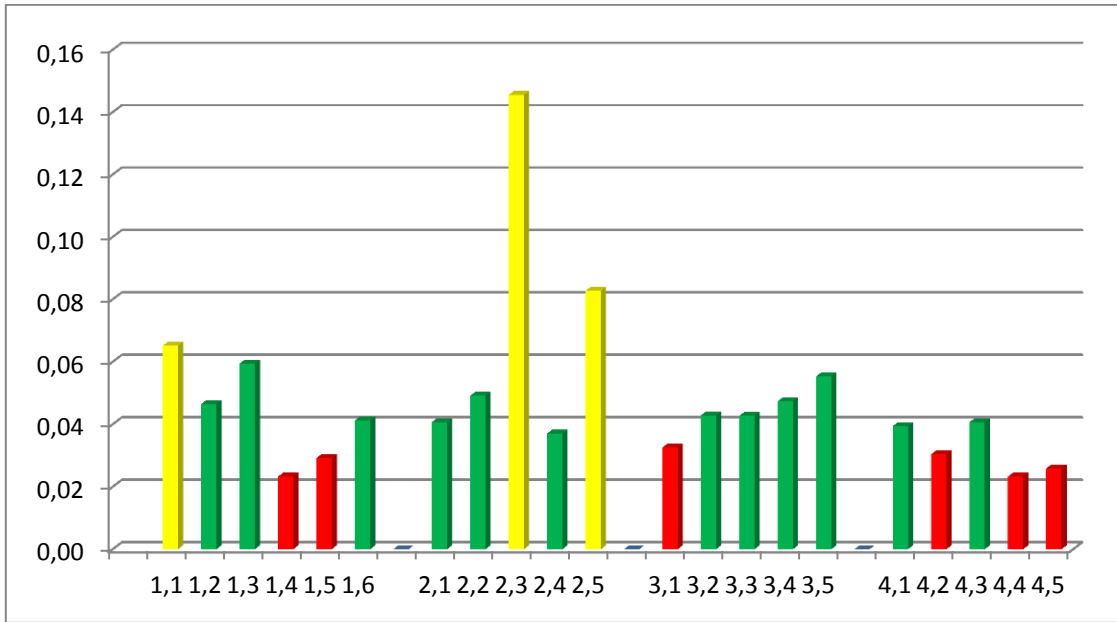
- Standard deviation of experience: represents if respondents have similar answer regarding to one attribute for what they have experienced.

$$SD\ experience\ index = \frac{Std(experience)}{10} + 1$$

- Standard deviation of expectations: reflect if respondents have similar answer regarding to one attribute for expectation in a specific future.

$$SD\ expectation\ index = \frac{Std(expectation)}{10} + 1$$

When the calculations are ready, the results of CFI, BCFI and SCFI calculation can be presented in the following bar chart:



**Figure 5.** Example of the final bar chart to represents CFI, BCFI or SCFI results

#### 2.2.4. Method of Judgments for Critical Attributes

Once the bar chart is ready, three colors are used to define the level which one attribute are located: red for under resources attributes, green for normal attribute (not critical) and yellow for over recourses attributes. Both red and yellow bars (over and under resources attributes) are critical.

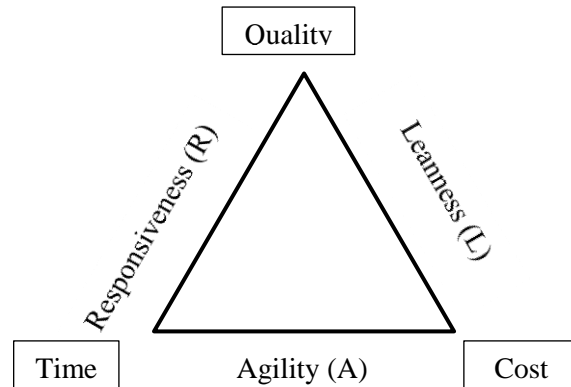
For make decision about the location of one attribute first the whole resource is counted to be 100% and it is divided to the total number of attributes to define the average resource level. Then an attribute is counted to be balanced and takes the green color if CFI

(BCFI/SCFI) value is between the range of  $1/3$  and  $2/3$  of average resource level. For the rest, if any attribute has lower value than  $1/3$  of average resource level then it is counted to be under resourced and takes the red color. If one attribute has higher value than  $2/3$  of average resource level is counted to be over resourced and takes the yellow color (Liu et al. 2011).

#### 2.2.5. RAL Model

The way to integrate Miles & Snow Topology (Miles 1978) into Sense and Response methodology is to use RAL Model. RAL is abbreviated from *Responsiveness*, *Agility* and *Leanness*. A firm can optimize the RAL model components (Responsiveness, Agility, Leanness) by prioritizing between cost, quality, time and flexibility (Takala 2012).

- ✓ Responsiveness: is firm's ability to respond and react customers demand within the constraints of cost and time (Holweg 2005).
- ✓ Agility: is ability to adjust in competitive and turbulent environments. Yauch (2011) writes agility results to on time delivery with the optimal cost and quality.
- ✓ Leanness: which means to minimize waste which helps company to improve quality and reduce cost and delivery time (Senaratne 2008).



**Figure 6.** RAL Model (Takala 2007).

#### 2.2.6. The Questionnaire and Assigning of Attribute for RAL Model

The following table shows the list of attribute and how they are assigned to one of the key categories of RAL model: Quality (Q), Cost (C), Time/Delivery (T) and Flexibility (F) to implement Sense and Respond method.

**Table6.** Visual representation of the attributes divided between the RAL model elements

	ATTRIBUTES	
<b>Knowledge &amp; Technology Management</b>		
1.1	Training and development of the company's personnel	← Flexibility
1.2	Innovativeness and performance of research and development	← Cost
1.3	Communication between different departments and hierarchy levels	← Time
1.4	Adaptation to knowledge and technology	← Flexibility
1.5	Knowledge and technology diffusion	← Cost
1.6	Design and planning of the processes and products	← Time
<b>Processes &amp; Work flows</b>		
2.1	Short and prompt lead-times in order-fulfillment process	← Flexibility

	ATTRIBUTES	
2.2	Reduction of unprofitable time in processes	← Cost
2.3	On-time deliveries to customer	← Quality
2.4	Control and optimization of all types of inventories	← Quality
2.5	Adaptiveness of changes in demands and in order backlog	← Flexibility
Organizational systems		
3.1	Leadership and management systems of the company	← Cost
3.2	Quality control of products, processes and operations	← Quality
3.3	Well defined responsibilities and tasks for each operation	← Flexibility
3.4	Utilizing different types of organizing systems	← Flexibility
3.5	Code of conduct and security of data and information	← Cost
Information systems		
4.1	Information systems support the business processes	← Time
4.2	Visibility of information in information systems	← Time
4.3	Availability of information in information systems	← Time
4.4	Quality & reliability of information in information systems	← Quality
4.5	Usability and functionality of information systems	← Quality

### 2.2.7. Technology IMPL

The following formulas show the level of deviation between the participants' responses in terms of technology share. In fact this is a measurement to how close are the answer of respondents. The lower the value of an attribute means the results are more reliable (Takala, 2012).



$$IMPL\ Basic = \frac{std\ \{Basic\ Technology(\%)\}}{avg\ \{Basic\ technology(\%)\}} \quad (4)$$

$$IMPL\ Core = \frac{std\ \{Core\ Technology(\%)\}}{avg\ \{Core\ technology(\%)\}} \quad (5)$$

$$IMPL\ Spearhead = \frac{std\ \{Spearhead\ Technology(\%)\}}{avg\ \{Spearhead\ technology(\%)\}} \quad (6)$$

$$Technology\ IMPL = \sqrt{\sum (IMPL\ Basic^2 + IMPL\ Core^2 + IMPL\ Spearhead^2)} \quad (7)$$

#### 2.2.8. Manufacturing Strategy Index

Manufacturing Strategy Index (MSI) is derived from the calculation done with S&R. In order to calculate MSI, the attributes from OP (Operations) questionnaire are assigned to one of the key categories of RAL model which are Quality (Q), Cost (C), Time/Delivery (T) and Flexibility (F). When the factors are assigned to each attribute, calculating the whole figures from CFIs calculation for Cost, Time, Quality and Flexibility the total share of these factors are obtained. Next step is to normalize these numbers which are as follow (Takala 2007):

$$Q\% = \frac{Q}{Q + C + T} \quad (8)$$

$$C\% = \frac{C}{Q + C + T} \quad (9)$$

$$T\% = \frac{T}{Q + C + T} \quad (10)$$

$$F\% = \frac{F}{Q + C + T + F} \quad (11)$$

Next step is to calculate MSI of operational competitiveness in each group as follow (Takala, Kamdee, Hirvelä, Kyllonen 2007):

- The MSI model for prospector group:

$$\phi \sim 1 - \left(1 - Q\%^{\frac{1}{3}}\right) (1 - 0.9 * T\%) (1 - 0.9 * C\%) * F\%^{1/3} \quad (12)$$

- The MSI model for analyzer group:

$$\lambda \sim 1 - (1 - F\%) [ABS[(0.95 * Q\% - 0.285) * (0.95 * T\% - 0.285) * (0.95 * C\% - 0.285)]]^{1/3} \quad (13)$$

- The MSI model for defender group:

$$\varphi \sim 1 - \left(1 - C\%^{\frac{1}{3}}\right) (1 - 0.9 * T\%) (1 - 0.9 * Q\%) * F\%^{1/3} \quad (14)$$

Once SCA values are calculated, next step is to evaluate how much the resource allocation supports the company's strategy. As the SCA value approaches to 1, the consistency between resource allocation and strategy becomes stronger.

MAPE (absolute percentage error):

$$MAPE = 1 - \sum_{\alpha, \beta, \gamma} \left| \frac{BS - BR}{BS} \right| \quad (15)$$

RMSE (root means squared error):

$$RMSE = 1 - \sqrt{\sum_{\alpha, \beta, \gamma} \left( \frac{BS - BR}{BS} \right)^2} \quad (16)$$

MAD(Maximum deviation):

$$MAD = 1 - \max_{\alpha, \beta, \gamma} \left| \frac{BS - BR}{BS} \right| \quad (17)$$

### 3. METHODOLOGY OF THE RESEACH

#### 3.1. Method

In order to answer the research questions, seven case studies are investigated. These companies are located in Oulu south region of Finland and are considered among Small and Medium (SME) size of business.

Cases are studied troughs Sense and Response(S&R) questionnaire which is presented earlier. In order to gather information, interviews with manager or a person from managements group are conducted. All the interviews are conducted during the meeting or by phone. The numbers of interviews are as follows:

- ✓ Company A: three respondents
- ✓ Company B: three respondent
- ✓ Company C: one respondent, for this case company calculation of CFI is not possible as results of one interview.
- ✓ Company D: two respondents
- ✓ Company E: three respondents
- ✓ Company E: three respondents
- ✓ Company G: three respondents

After conducting interview, the SCA factors are calculated for each company, also risk levels for companies' strategy are evaluated. Later on, to estimate how much these results are valid and meet reality, second interview are conducted. This time the results are presented to the mangers from each company and ask them how much the results are close to their situation according to their point of view. The process of validating results is called "Weak market test" (WMT).

The WMT are conducted also successfully for most of the companies, but unfortunately it was not possible to conduct interview with the managers from companies A and D in this step so the results of WMT is not available.

### 3.2. Case Introduction, Oulu South Region of Finland

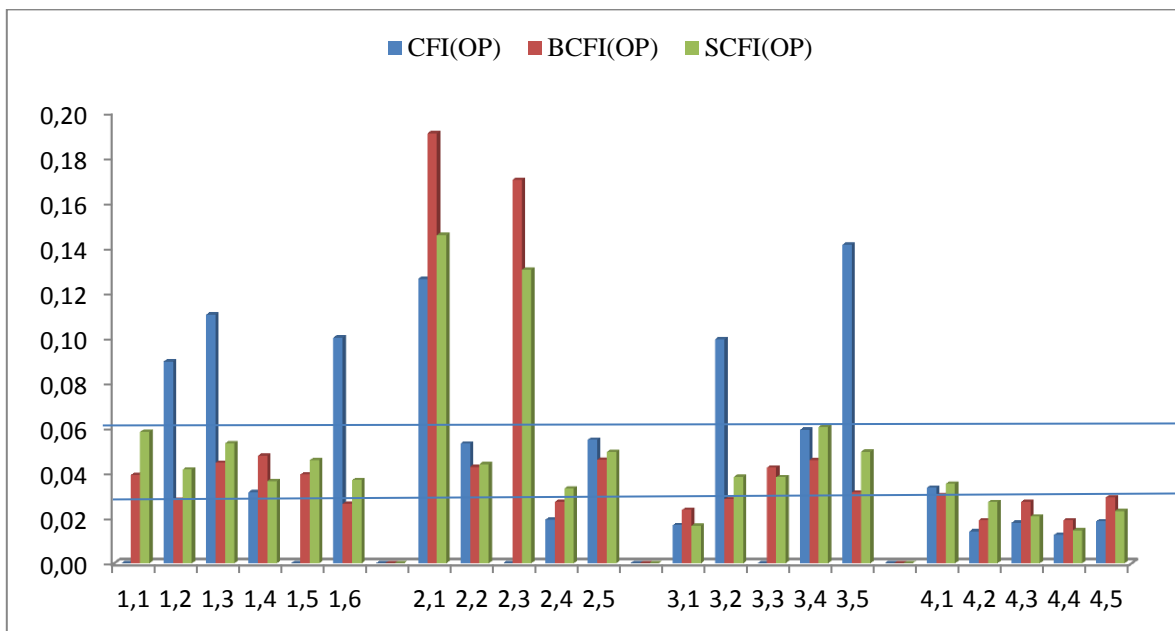
Oulu South Area is located in Northern Ostrobothnia. This area is one of the centers of agricultural products in Finland. Besides agricultural products, metals, wood industry, and information and communication technology (ICT) are active in Oulu South region. The lowest unemployment rate in northern Finland belongs to this region and the majority of the population is young, Oulu South is a business-friendly area and currently there are about 4,600 active companies. About 95% of companies in this region are micro-enterprises.

## 4. EMPIRICAL RESEARCH

### 4.1. Case Company A

This case produces finished wooden decorative moldings and panels. A company's operation is based on using high quality material, produces high quality product that are environments friendly. Besides, Company A attempts to have reliable delivery (source company website).

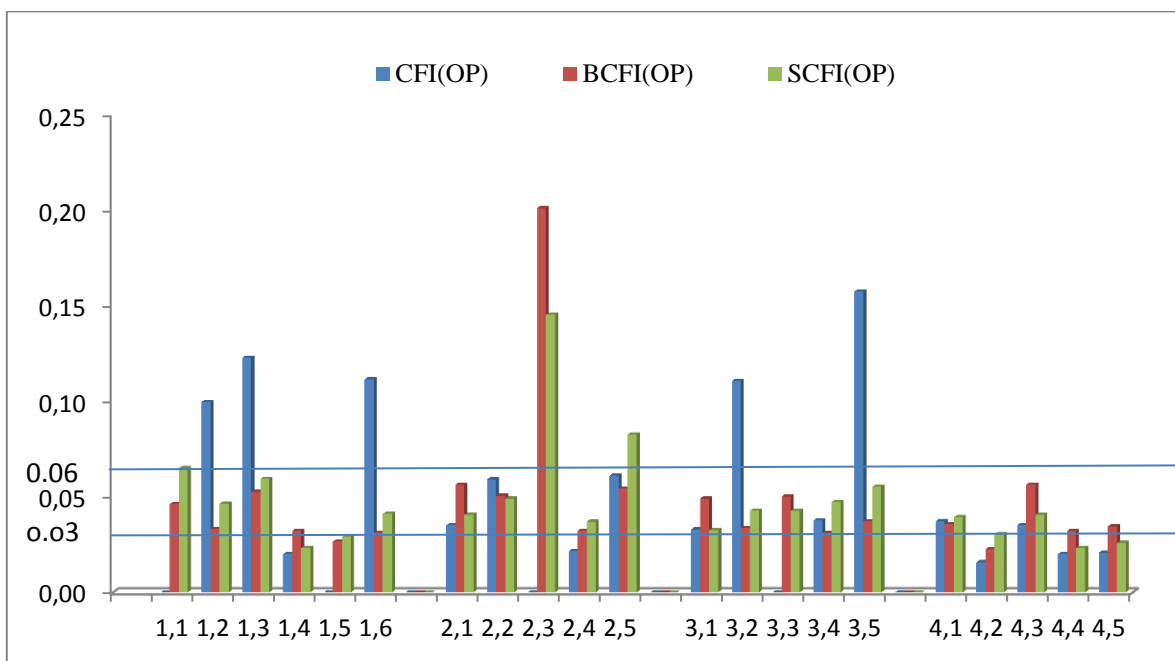
The first bar charts demonstrates the CFIs calculation for Company A in past. According to method of judgments the balanced limit is between 0.03 and 0.6 which are drawn in this bar chart.



**Figure 7.** Presentation of extreme attributes for company A (past strategy)- CFIs analysis

According to the bar chart two attributes, 2.1(Short and prompt lead-times in order-fulfillment process) and 2.3(On-time deliveries to customer) are considered as most critical in past.

Figure 8, demonstrates the results of CFIs analysis for company A in future. As the bar chart shows a lot of attributes are located in balanced area. For Company A, The most potential factor which needs to be located at the center of attention in future is attribute 2.3,“On time delivery”.



**Figure 8.** Presentation of extreme attributes for company A (future strategy)- CFIs analysis

Matches between these two bar charts (past and future analysis) shows the main concerns of company is to improve on time delivery. Considering company’s goal which focuses on quality and good delivery, the importance of this result becomes clear.

In figure 9 ,the comparison between the experiences and expectations for company A is demonstrated. Investigating this bar chart shows that the level of resources is improved for most of criteria in future. Also the bar chart shows the level of four attributes remains

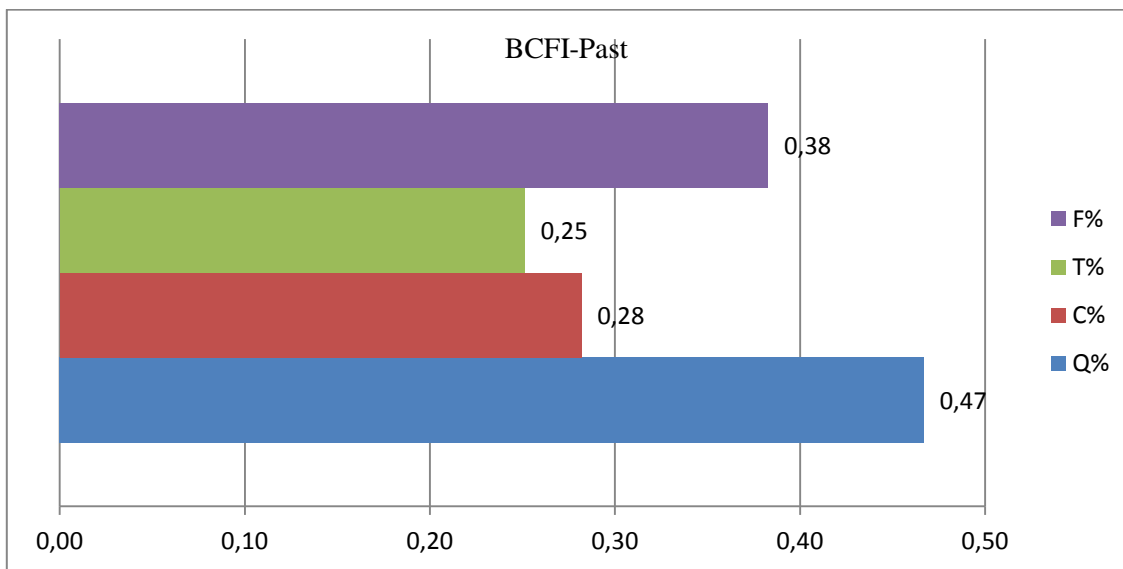
unchanged. These four attributes are: 3.5” Code of conduct and security of data and information, 4.2” Visibility of information in information systems”, 4.3” Availability of information in information systems and 4.4” Quality & reliability of information in information systems.



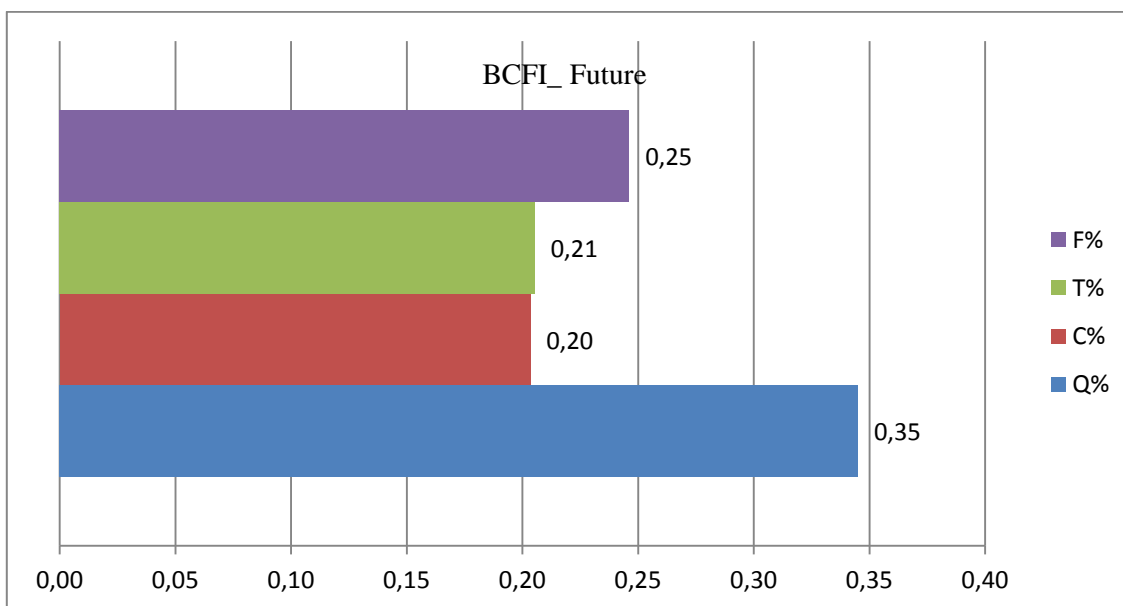
**Figure 9.** Comparison between expectations and experiences for company A

Figure 10 and 11 show competitive priorities for company A in past and future.





**Figure 10.** Competitive priorities in past- Company

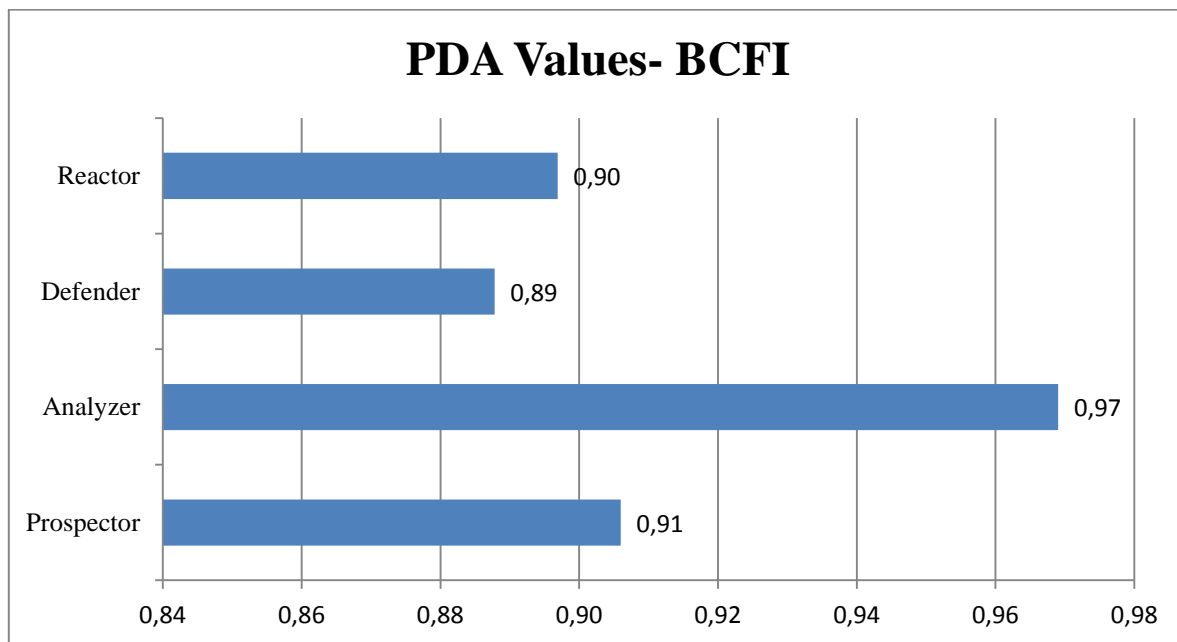


**Figure 11.** Competitive priorities in future- Company A

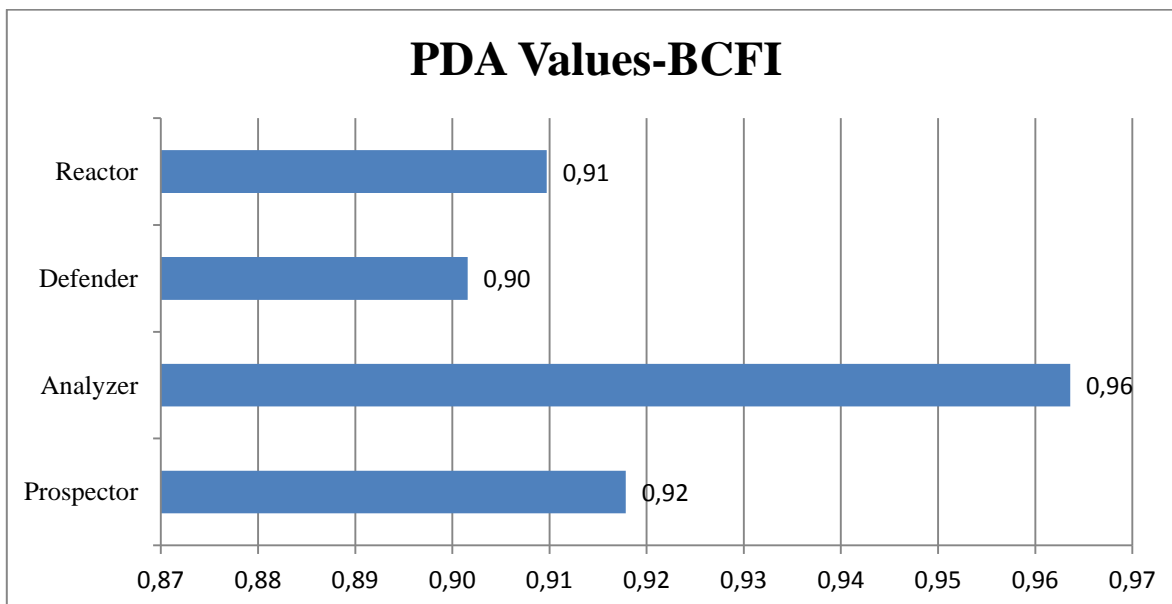
Matches between these two charts shows quality is the most important priorities for this company. Share of quality for past and future company strategy is 0.47 and 0.35 respectively which shows, in future company has less concentration on quality compared to past.

The next to bar charts show operational competitiveness in category PAD in past and future. Both bar charts show the position of analyzer for company A in past and future. This position represents the balance between quality and flexibility which is proved in the results of figure 12 and 13.

Comparing figure 12 and 13 shows the company A strategy is sustainable and there is no significant difference between the position of company is past and future.

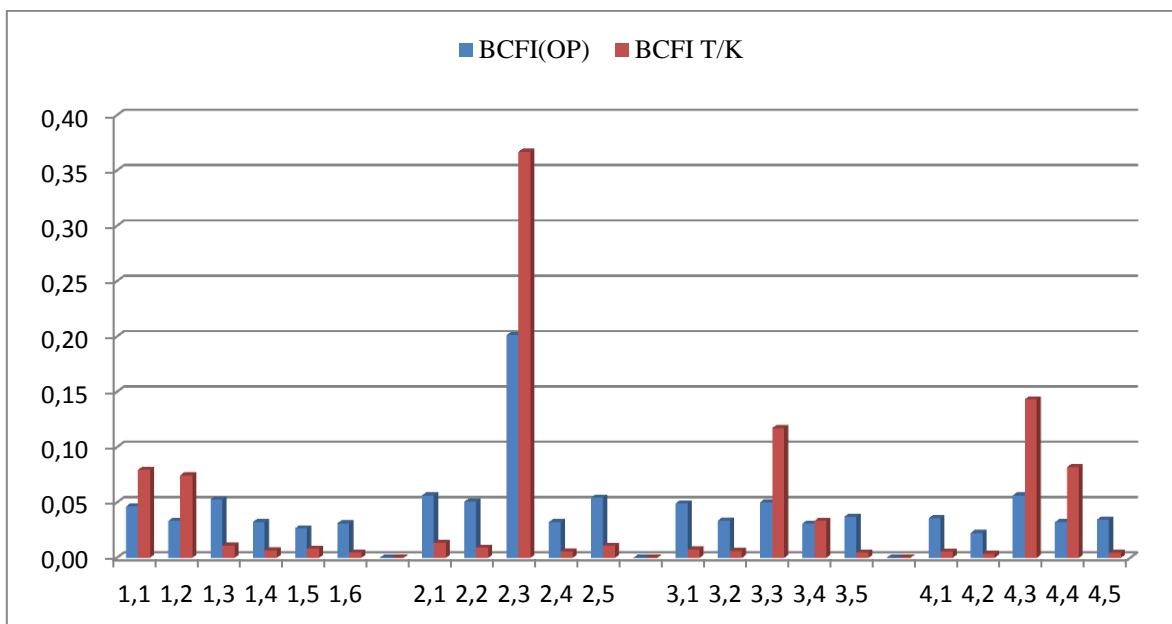


**Figure 12.** PDA values in past- Company A



**Figure 13.** PDA values in future- Company A

In figure 14, the blue bars represent the traditional BCFI values and the red bars stand for BCFI values considering technology and knowledge effect.



**Figure 14.** BCFI and BCFI T/K-Company A

Considering the balance limits, it can be concluded that adding T/K calculation guides most of the attribute to more critical levels. The bar chart also presents including T/K calculation dose not necessary guide all the attributes to over resources or under resources area. In fact, there is not any distinct direction in the changes of level of different attribute including T/K calculation.

In tables 7 and 8 SCA risk level for past and future of company A strategies are demonstrated:

**Table 7.** SCA risk level (past)- Company A

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>
<b>MAPE</b>	0.95	0.88	0.87
<b>RMSE</b>	0.96	0.92	0.92
<b>MAD</b>	0.97	0.94	0.94

**Table 8.** SCA risk level (future)- Company A

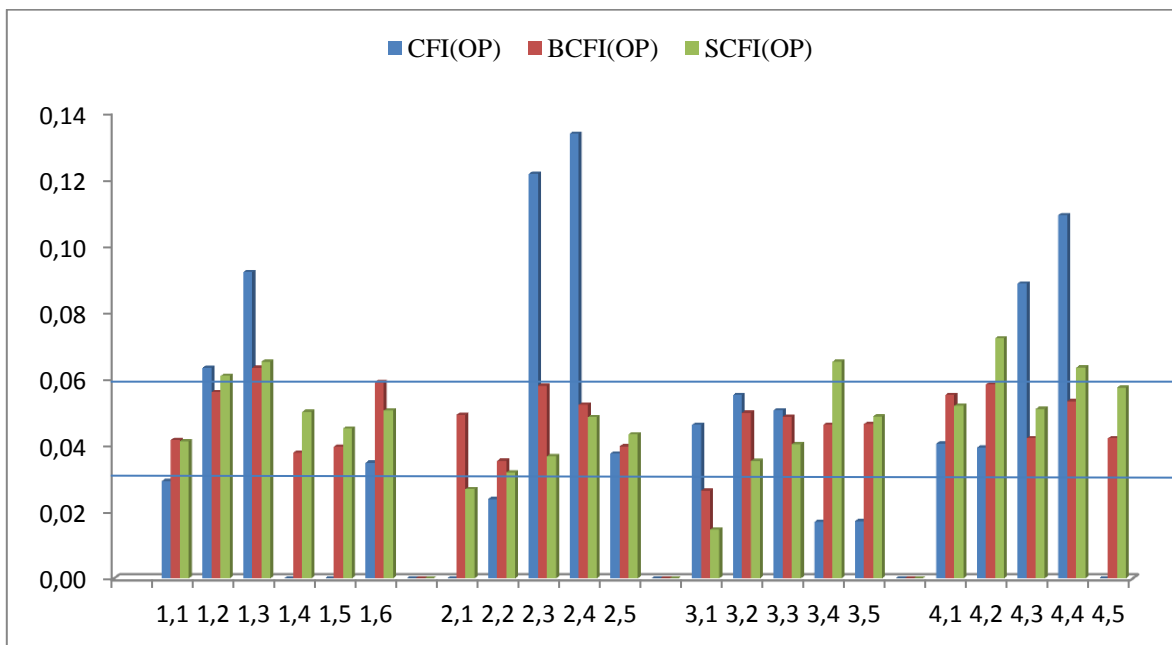
	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.88	0.98	0.98	0.80
<b>RMSE</b>	0.93	0.99	0.99	0.88
<b>MAD</b>	0.94	0.99	0.99	0.90

Comparison between these two tables shows the resources allocation for different attributes follows company strategy better in future than in past. Another important result is including T/K calculation to BCFI increases the SCA risk level for company A. Finally, as the risk level is almost less than 10% according to all the calculation so it is concluded that in general resources allocation follows company strategy well

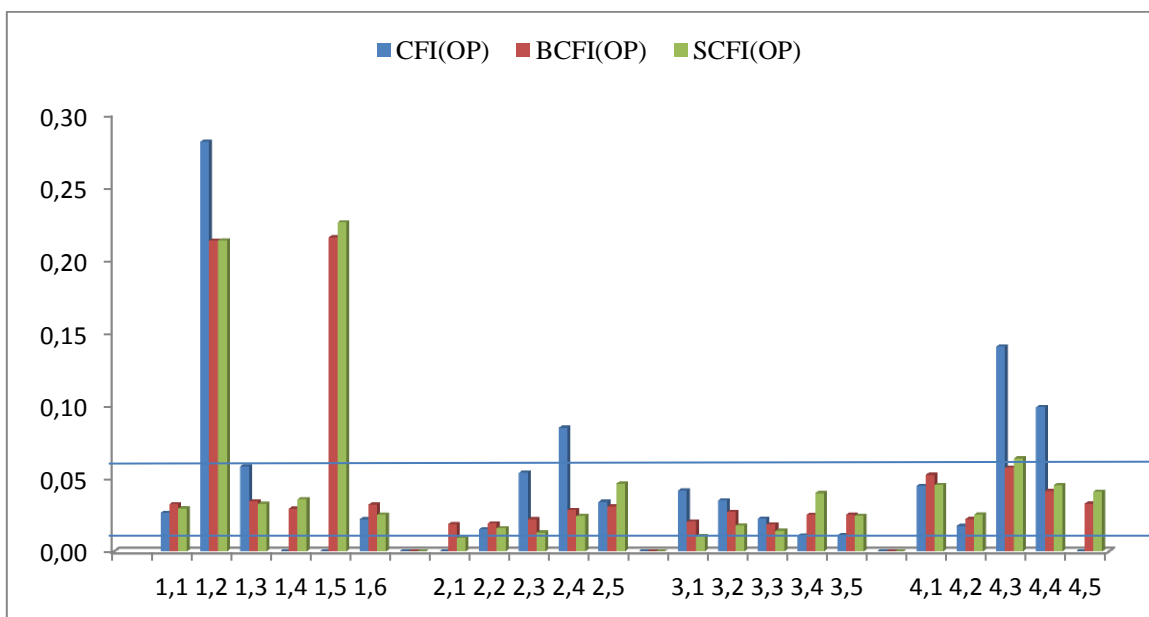
#### 4.2. Case Company B

Company B is established 1995. This high tech company designs and manufactures brake roller tester and brake testing systems. Company B's customers are mainly Finnish market at the same time company B intends to enter to not only Europe but also the whole world. Company B plans to apply EFQM considering customer focus, results orientation, managements by process continues learning, public responsibility and innovation and improvements (source: company web site).

Bar charts 15 and 16 demonstrate the CFIs calculation for Company B in past and future respectively.



**Figure 15.** Presentation of extreme attributes for company B (past strategy) - CFIs analysis



**Figure 16.** Presentation of extreme attributes for company B (Future strategy)- CFIs analysis

According to method of judgments the balanced limit is between 0.03 and 0.06. Hence. CFIs analysis shows most of the attributes are located in balance level in past and future.

In past strategy of company B the following attributes are considered as critical: 1.3” Communication between different departments and hierarchy levels”, 2.3 “On-time deliveries to customer”, 2.4 “Control and optimization of all types of inventories” and 4.4 “Quality & reliability of information in information systems”. Considering the category which these attribute are belonged to, it is concluded that the main concern of company in past is quality.

On the other hand, the following attributes are considered as critical in future for company B: 1.2” Innovativeness and performance of research and development”, 1.5” Knowledge and technology diffusion” and 4.3” Availability of information in information systems”. Considering the category of these attributes, the company main concern in future is cost and time.

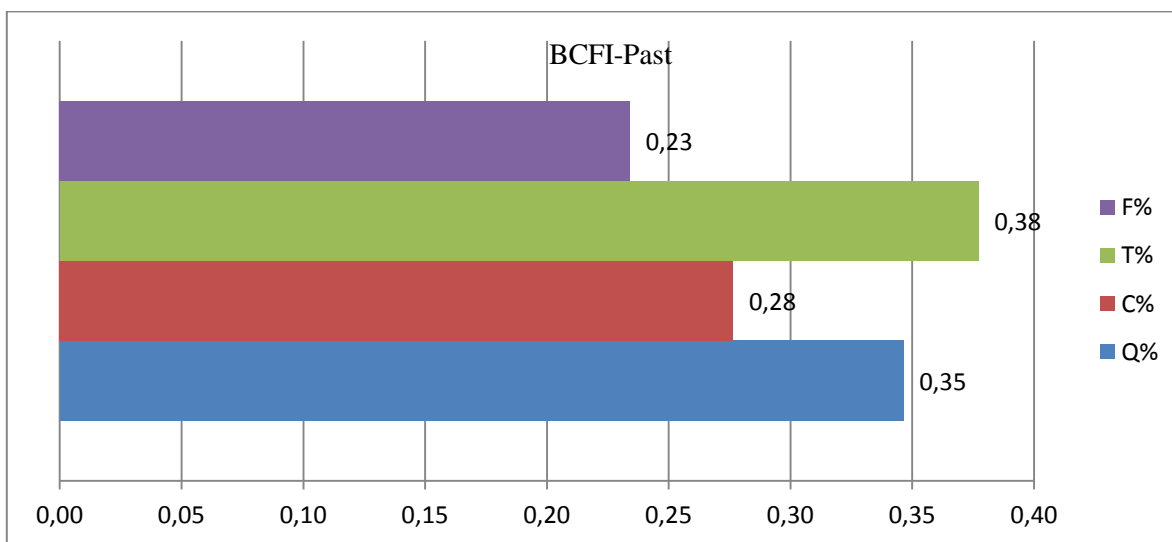
In general, the company will switch from quality to cost in future.

Figure17 presents the comparison between experience in past and expectation in future for different attributes. In general there are enhancements in the level of all the attributes in future. The chart also shows the average level of expectation is 8 for all attributes while the medium level of experience is 7. Besides, the lowest level of experience belongs to attribute 3.1 “Leadership and management systems of the company” which is less than 6 in past and increases up to 8 in future.



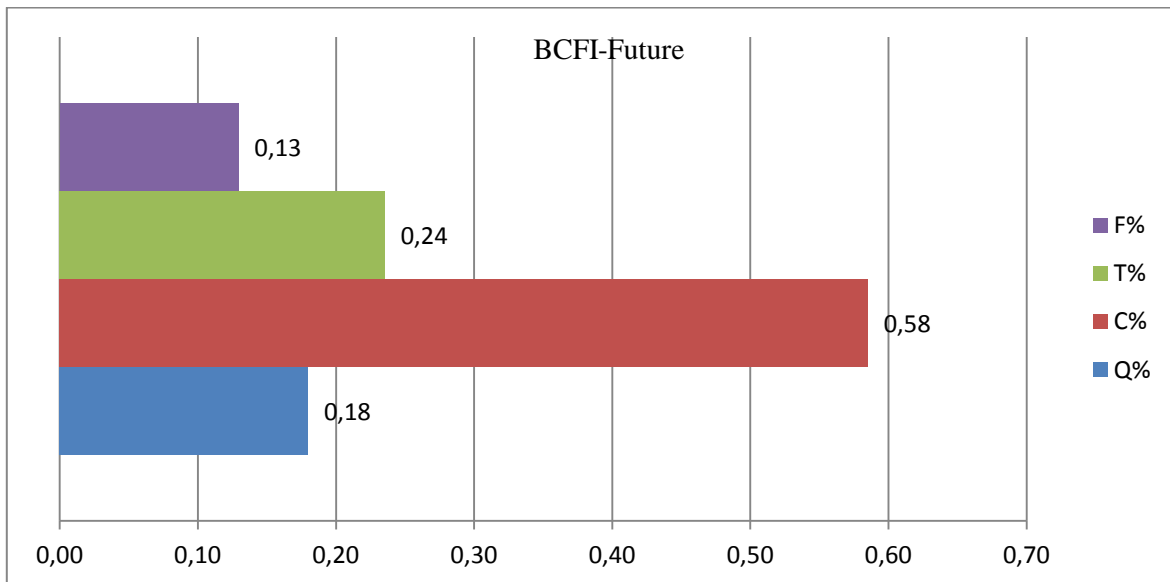
**Figure 17.** Comparison between expectations and experiences for company B

Figure 18 and 19 show competitive priorities for company B in past and future.



**Figure 18.** Competitive priorities in past- Company B

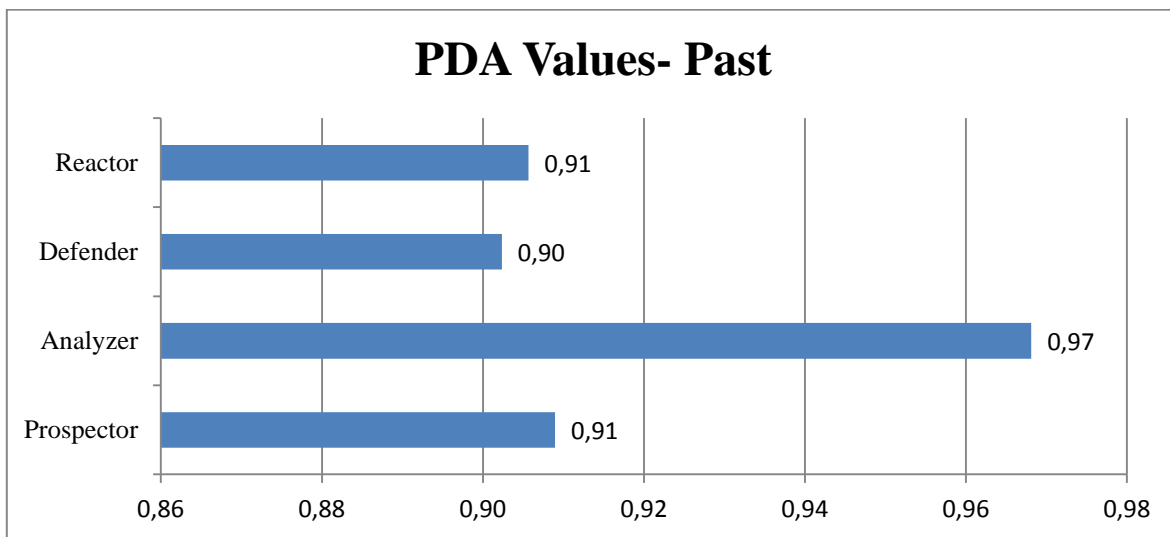




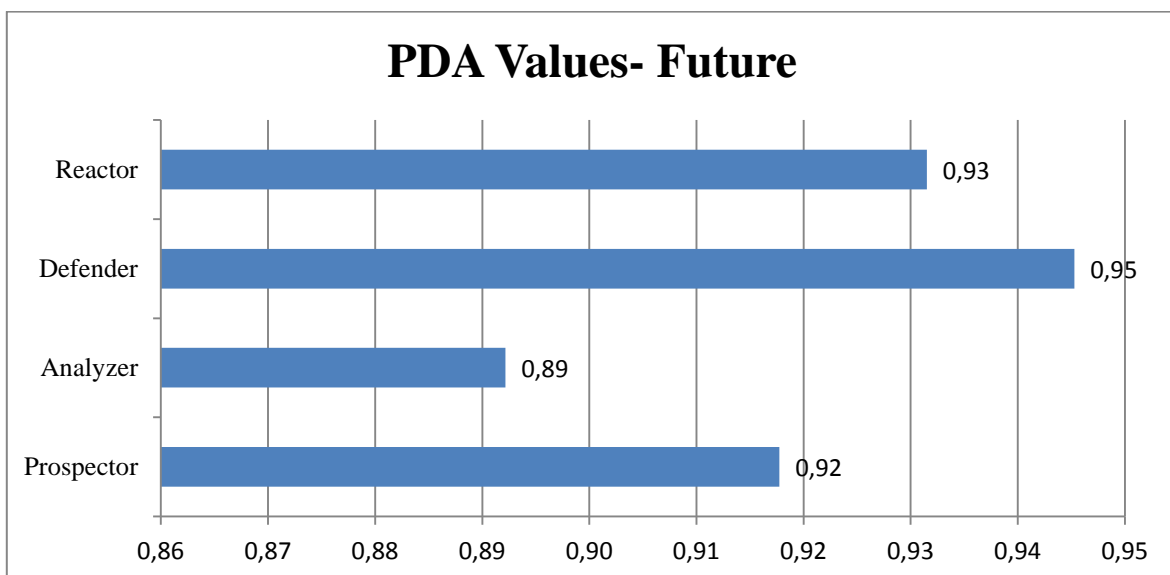
**Figure 19.** Competitive priorities in future- Company B

Comparison between these two bar charts shows that in past the main focus of company strategy is time and quality while the main focus of company strategy in future is cost.

The next two bar charts demonstrate operational competitiveness in category PAD for past and future.



**Figure 20.** PDA values in past- Company B

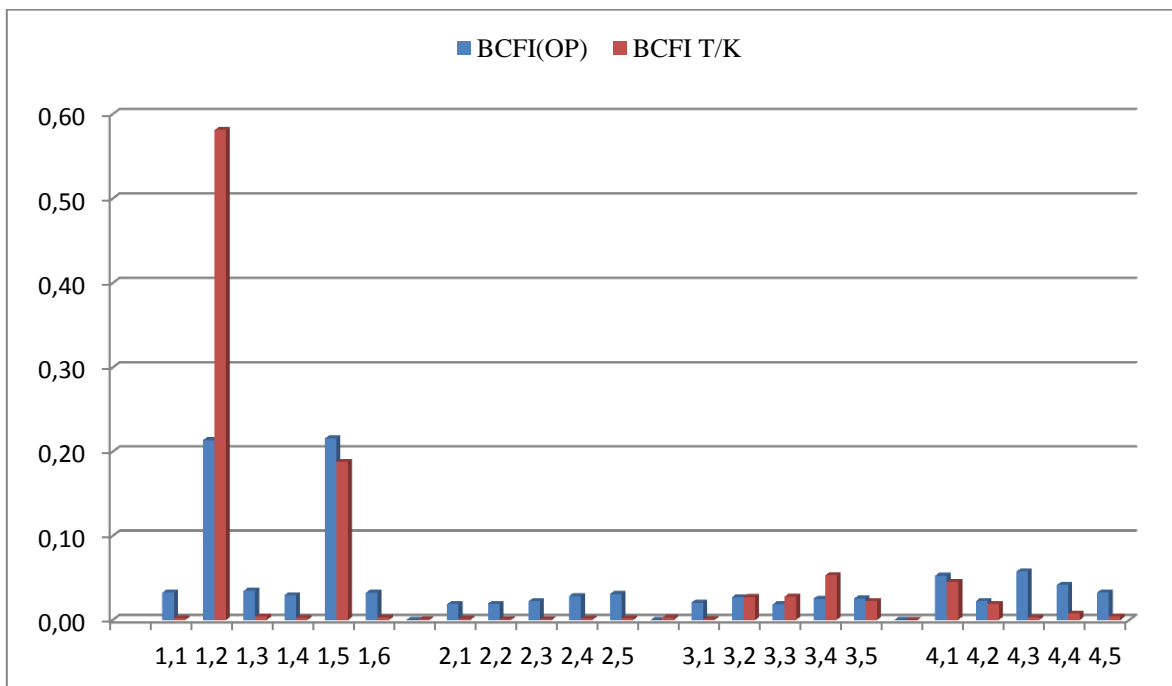


**Figure 21.** PDA values in future- Company B

Investigating these two bar charts shows that mainly company B acts as analyzer in past while it's strategy position is mainly defender in future. In fact, there is significant difference between company main position in past and in future in terms of PDA values.

In detail, PDA values for company B in past, are 0.97 for analyzer and around 0.90 for other position. On the other hand, PDA values for company B in future are: 0.89 for analyzer and 0.93, 0.95 and 0.92 for Reactor, defender and Prospector respectively. As the PDA values for company B change significant in future in comparison to the past, so the company strategy could not be sustainable.

In the next bar charts the comparison between traditional BCFI calculations and T/K BCFI calculation for company B are demonstrated.



**Figure22.** BCFI and BCFI T/K- Company B

The bar chart shows adding technology and knowledge calculation do not guide all the attributes to a distinct direction. For some attributes adding technology and knowledge increases the level of resources and for some of them, decrease the level of resources.

In the tables 9 and 10, SCA risk levels for company B strategies are presented.

**Table 9.** SCA risk level (past)- Company B

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>
<b>MAPE</b>	0.95	088	0.87
<b>RMSE</b>	0.96	0.92	0.92
<b>MAD</b>	0.97	0.94	0.94

**Table 10:** SCA risk level ( future)- Company B

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.88	0.98	0.98	0.80
<b>RMSE</b>	0.93	0.99	0.99	0.88
<b>MAD</b>	0.94	0.99	0.99	0.90

According to what is explained in theory back ground, SCA risk level shows how much company strategies are supported with resource allocation. The more these figure are close to 1 the more strategy are supported. And the answer from 1 mines SCA values shows risk level. For company B the risk level is around 10% in general. So it is concluded that the company strategy is highly supported with resource allocations.

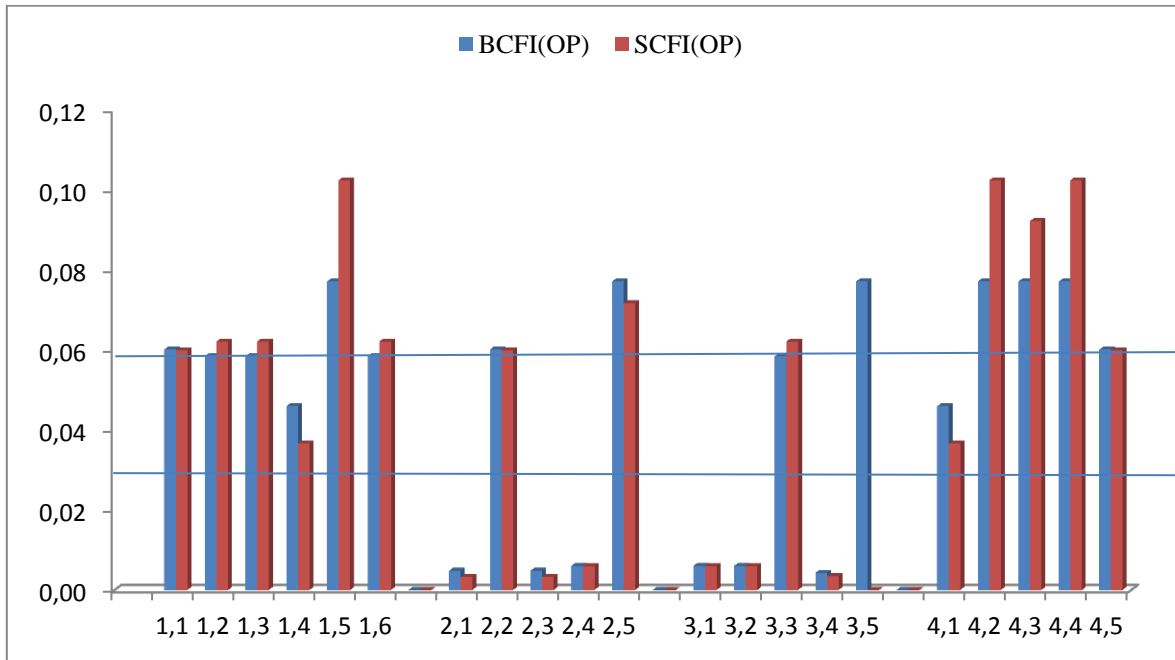
In company B, the results from WMT shows out comes of SCA method do not have any contraction in the operative level. Moreover, it shows company B has challenges with general strategy and owner ship.

#### 4.3.Case Company C

Company C concentrates on producing sawmills. This company was established 70 years ago in a place which has good forest. This factory also is located in a very good condition which is close to road and sea routs. Today this company is so successful in modern sawn timber (source: company web site)

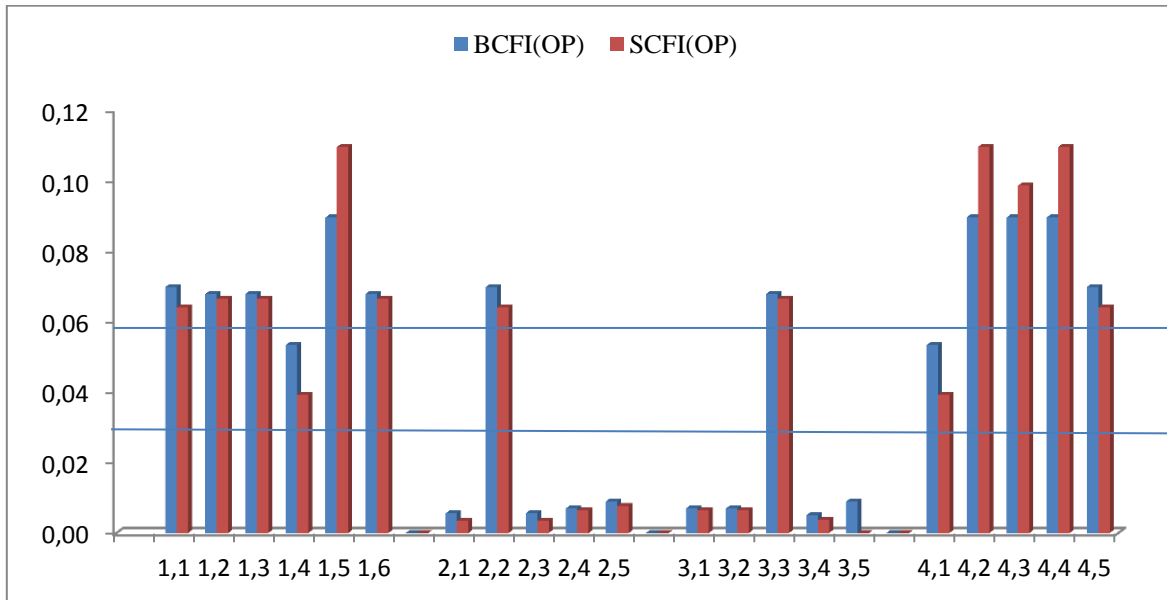
As for this company only one respondent is interviewed, so the calculation of CFI is not possible; however there are some results which are presented in following.

The first two bar charts show the presentation of extreme attribute for company C considering the calculation of BCFI and SCFI.



**Figure 23.** Presentation of extreme attributes for company C (past strategy)- BCFI and SCFI

As above bar chart shows most of the attribute are located between balanced lines. However there are 6 attributes which are considered as critical in past. These attributes are: 1.5” Knowledge and technology diffusion” , 2.5 “Adoptiveness of changes in demands and in order backlog” , 3.5” Code of conduct and security of data and information”, 4.2 “Visibility of information in information systems”, 4.3 “Availability of information in information systems” and 4.4 “Quality & reliability of information in information systems”.



**Figure 24.** Presentation of extreme attributes for company C (future)- BCFI and SCFI

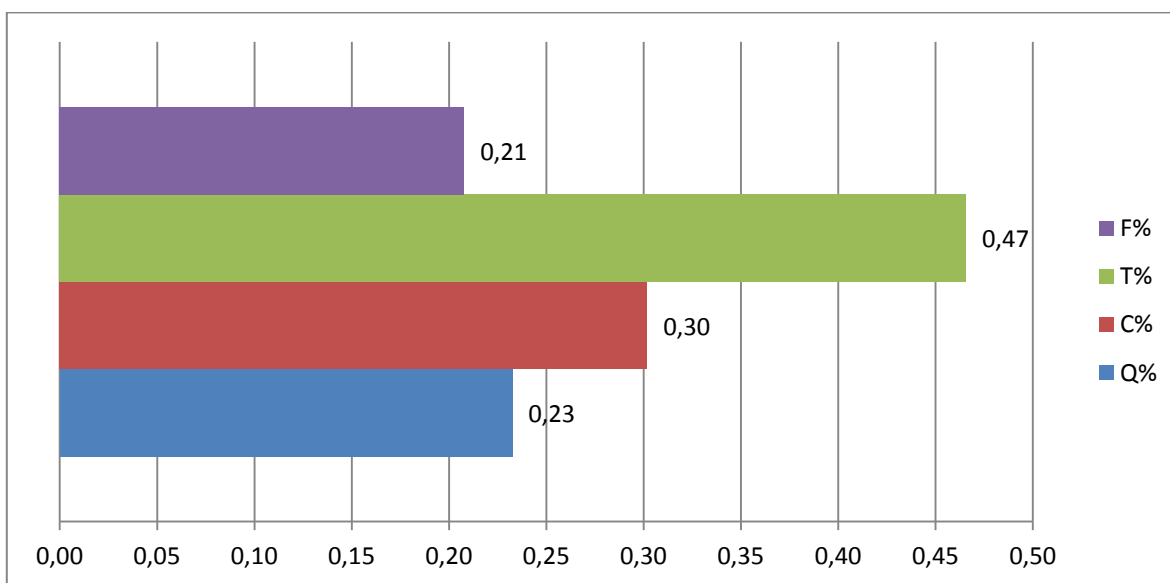
Investigating the demonstration of extreme attributes for future shows there are many criteria which are located in critical area. In fact, only two attributes as follow are in balance level: 1.4” Adaptation to knowledge and technology”, 4.1” Information systems support the business processes”.

Figure 26 shows the level of recourses for attributes in past and future. Like company B, there is enhancement in level of all the criteria in future. For company C, the medium level of expectation is 7 while the medium level of experience is 6. In company C, criteria 3.4, “Utilizing different types of organizing systems” has the lowest resource level in the past.



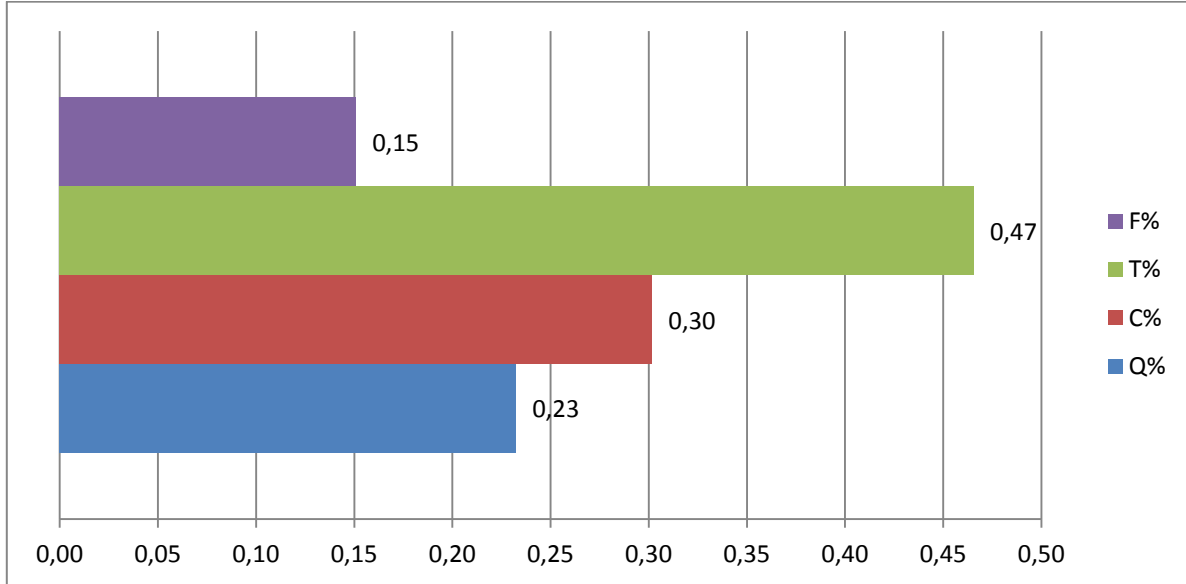
**Figure 25.**Comparison between expectations and experiences for company C

The next two bar charts present company C competitive priorities in past and in future.



**Figure 26.** Competitive priorities in past- Company C

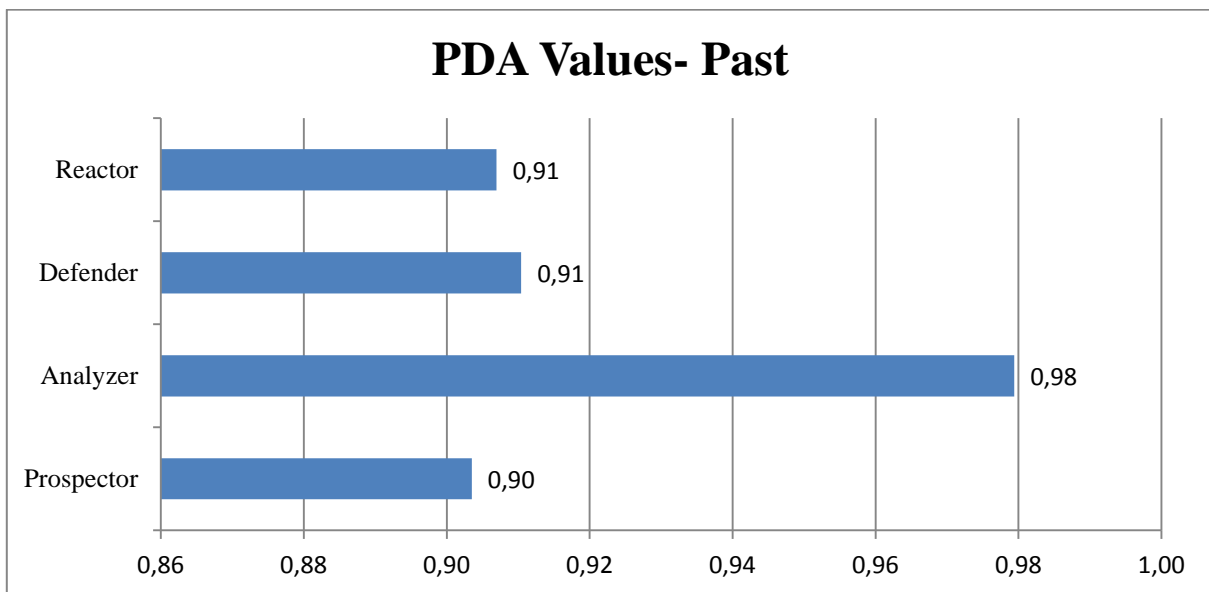




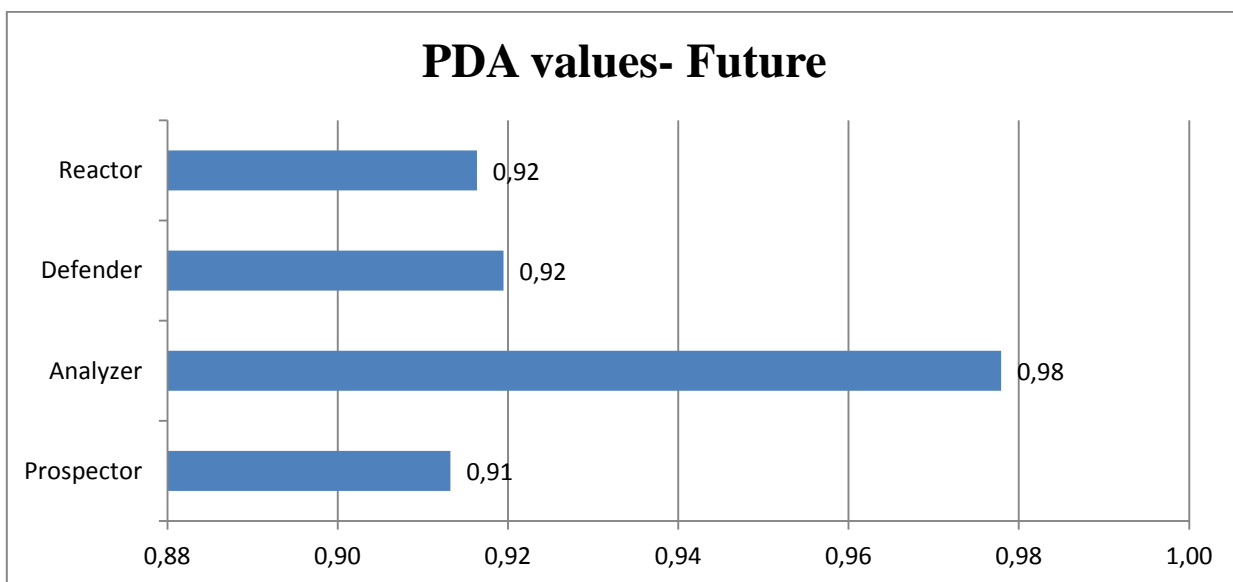
**Figure 27.** Competitive priorities in future- Company C

As the both bar charts show, the main focus for company C priority in past and future is Time. However, company has more focus on flexibility is past in comparison with in future. While the share of cost and quality remains unchanged in future.

PAD values for past and future company strategy are demonstrated in the next two bar charts. Comparison between these two bar charts shows company C has a sustainable strategy as there is no difference between the position of company in past and future. In other words, the position of company is analyzer in past and it remains unchanged in future.



**Figure 28.** PDA values in past - Company C



**Figure 29.** PDA values in future - Company C

In the tables 11 and 12, SCA risk level for company C strategy in past and future are demonstrated.

**Table 11.**SCA risk level (past)- Company C

	<b>BCFI</b>	<b>SCFI</b>
<b>MAPE</b>	0.94	0.92
<b>RMSE</b>	0.96	0.95
<b>MAD</b>	0.97	0.96

**Table 12.** SCA risk level (future)- Company C

	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.94	0.93	0.94
<b>RMSE</b>	0.96	0.95	0.96
<b>MAD</b>	0.97	0.96	0.97

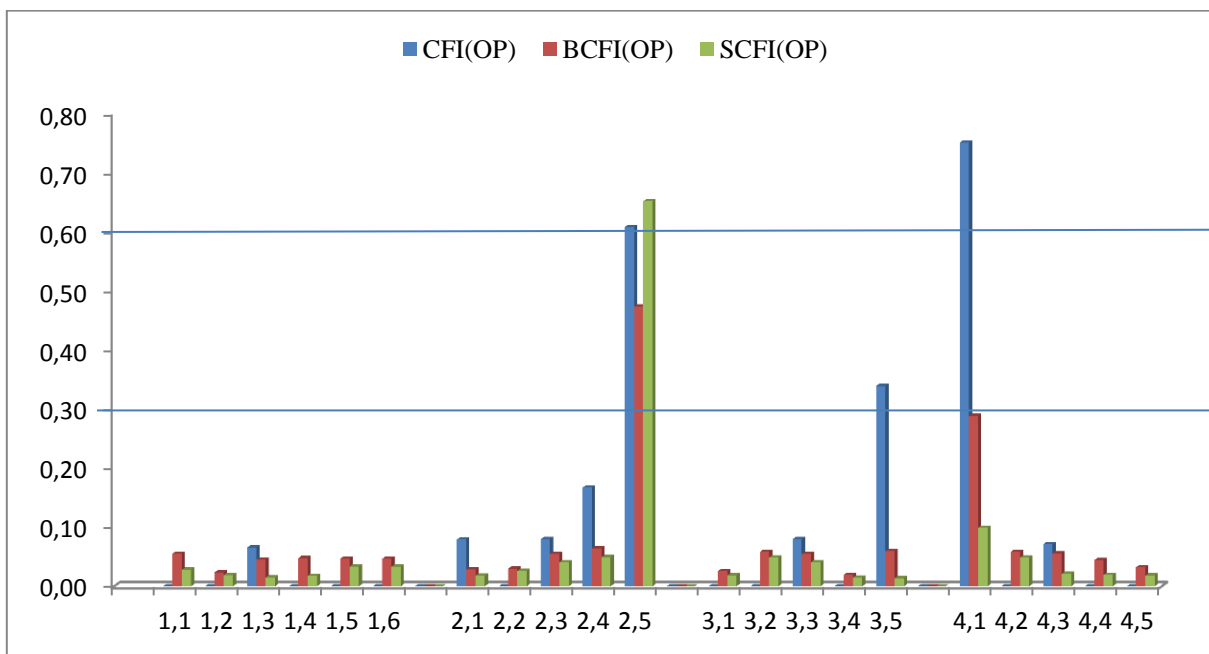
As tales show, resource allocation in company C highly supports company strategy because the SCA risk level is less than 0.10% for all methods.

In company C, the results from WMT show that the outcomes of SCA method is very exact. In fact, these results provides company manager new decision making tool. Moreover, it elaborates company's root problem.

#### 4.4. Case Company D

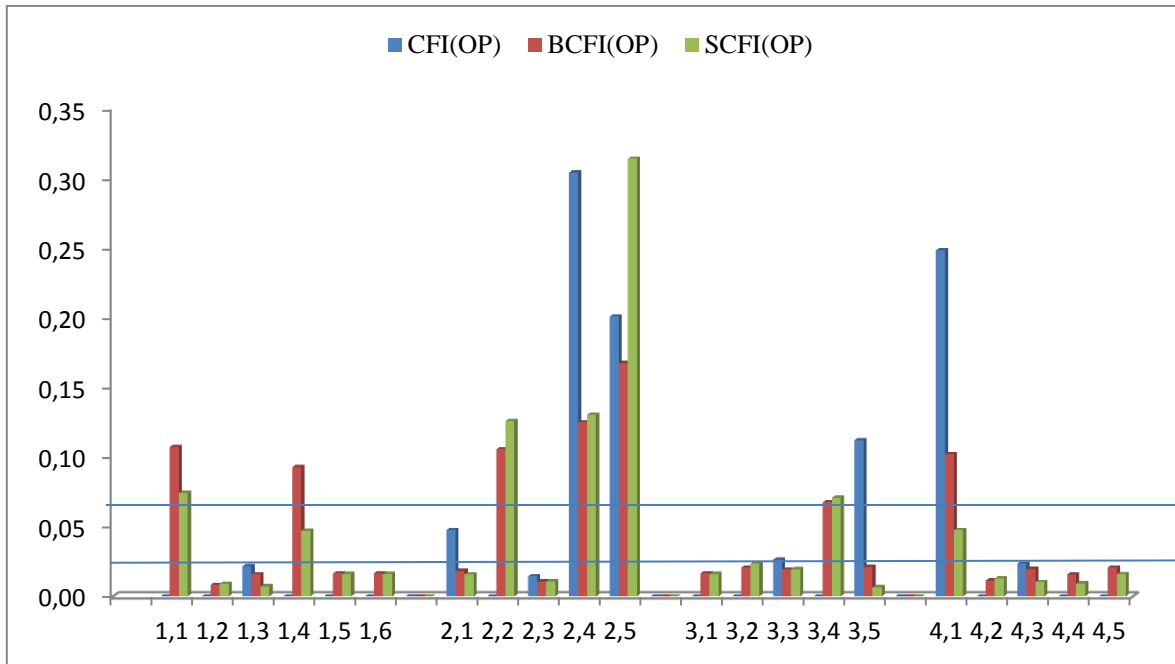
This company is established 50 years ago and manufactures timber products. Companies' mission is to stay pioneer in Finnish wood products industry.

The first two bar charts show CFIs analysis n past and in future.



**Figure 30.** Presentation of extreme attributes for company D (past strategy)- CFIs analysis

As figure 30 shows most of criteria are located in critical area. In fact, in company past situation analysis there is only one attribute which is in balance level: 2.5 “Adaptiveness of changes in demands and in order backlog”.



**Figure 31.** Presentation of extreme attributes for company D (future strategy)- CFIs analysis.

In future Company C strategy analysis, there are also a lot of critical attributes. The most potential critical attributes are: 2.4 “Control and optimization of all types of inventories “, 2.5” Adaptiveness of changes in demands and in order backlog” and 4.1” Information systems support the business processes “which are over resource attributes.

Matches between CFIs analysis for past and future shows that the criteria 2.5” Adaptiveness of changes in demands and in order backlog” is located in over resource area in both bar charts. It shows that this criteria is company’s problem now and it is also remains as problem in future.

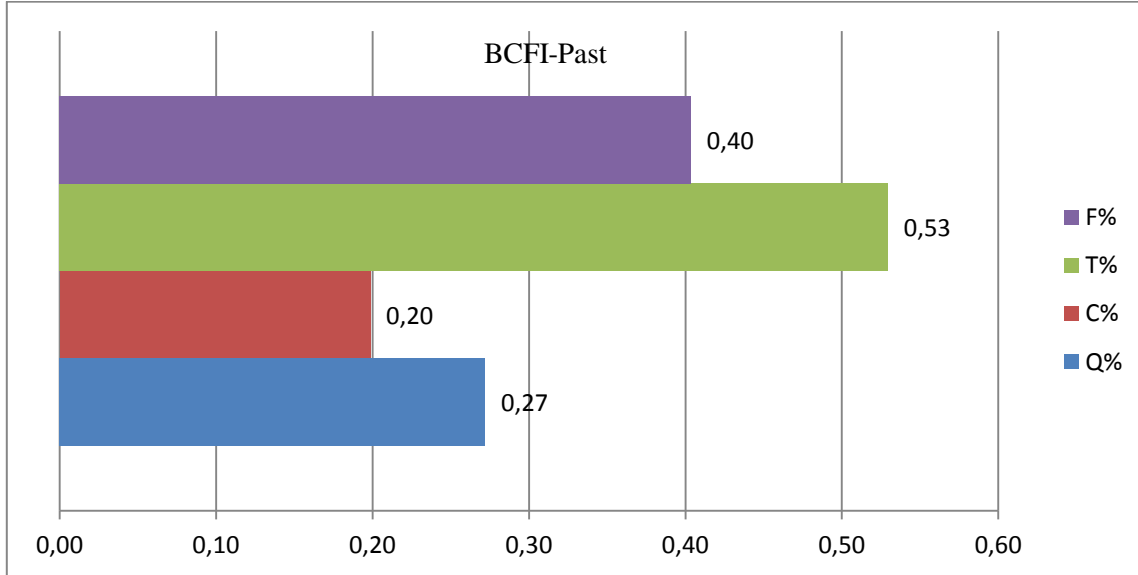
figure 32 demonstrates the comparison between the level of resource for experience in past and expectation in future in terms of different attributes.



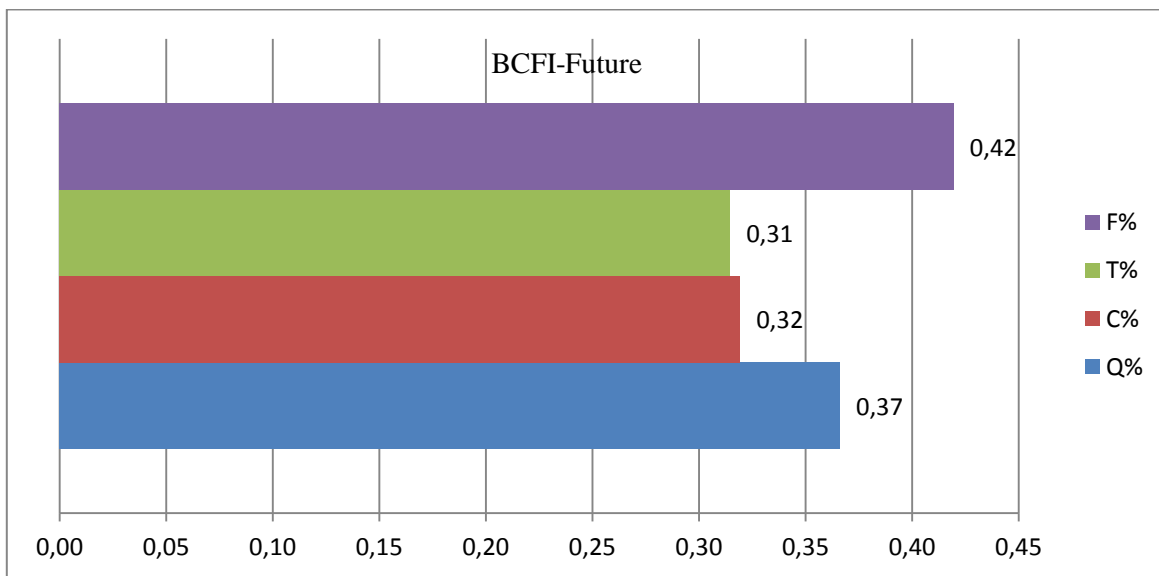
**Figure 32.** Comparison between expectations and experiences for company D

As the bar chart shows, there is improvement in the level of most the attributes in future, the only attribute which shows decreases in the level of resources is: 2.5” Adaptiveness of changes in demands and in order backlog”.

Figure 33 and 34 show the main focus of company D in past and future. As figures present, the main priority of company D is time in past while main concern of company D for future is flexibility and quality respectively.

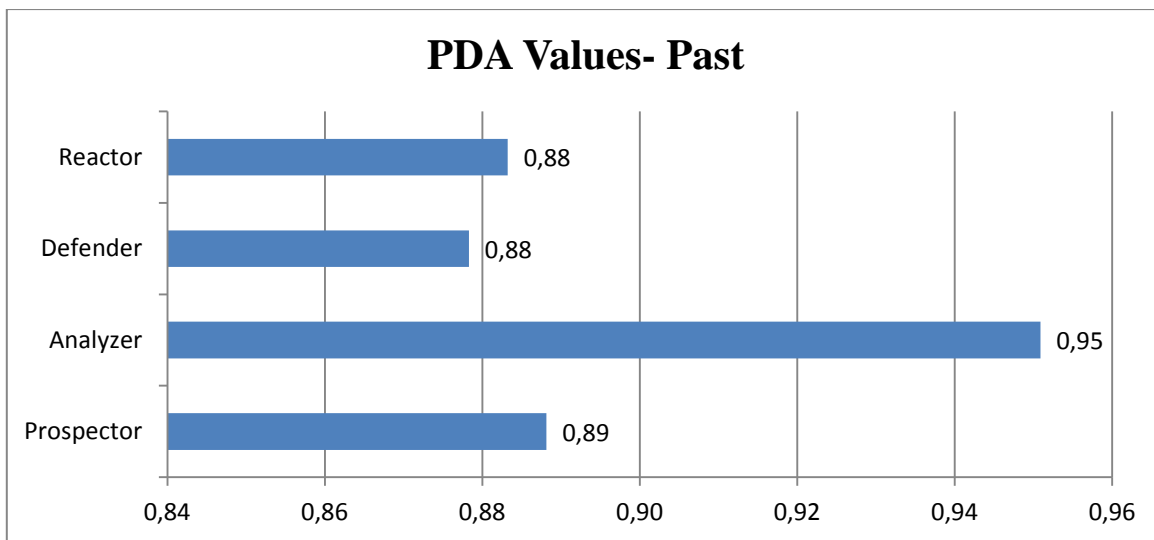


**Figure 33.** Competitive priorities in past- Company D

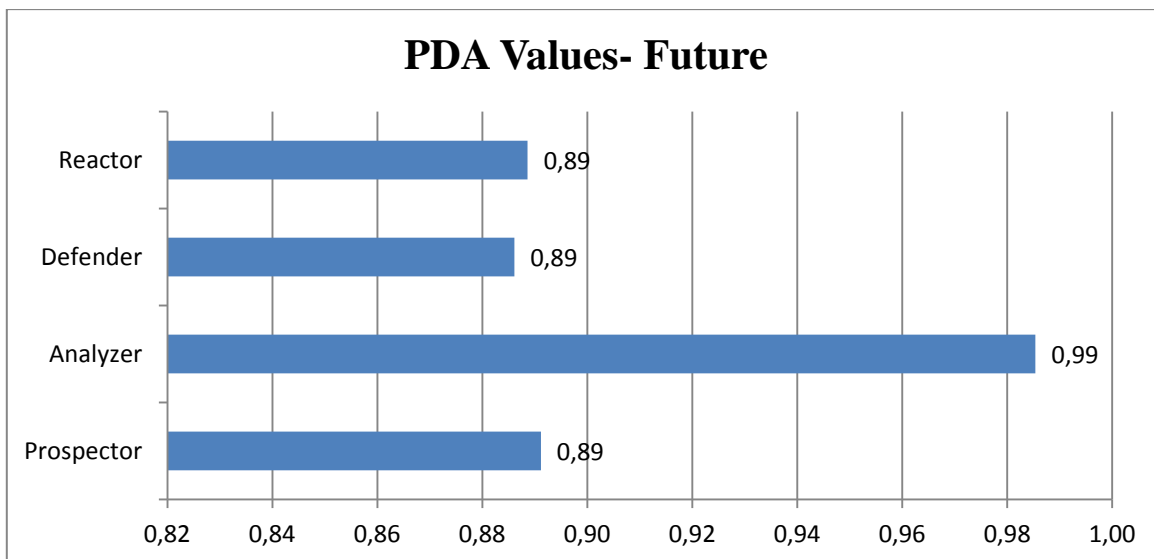


**Figure 34.** Competitive priorities in future- Company D

Figure 35 and 36 present PDA values for company D in past and future. as the bar charts show the position of company D is analyser in past and it remains unchanged in future. so it is concluded that company D is located between Prospector and Defender and tried to stay in market.



**Figure 35.** PDA values in past – Company D

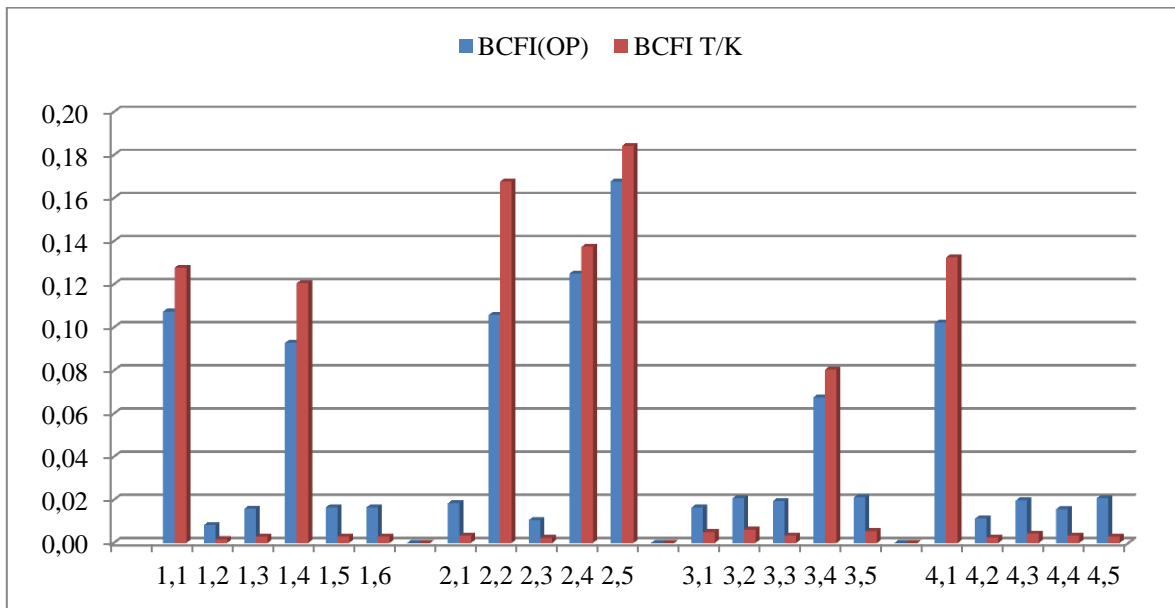


**Figure 36.** PDA values in future- Company D



Figure 37 compares the level of attributes results of BCFI and BCFI considering T/K.

Considering this bar chart and the level of balanced level, in can be concluded that including T/K factor guides all the criteria to more critical level.



**Figure37.** BCFI and BCFI T/K- Company B

SCA risk analysis for company D are represented in tables 13 and 14. As two tables show the company strategy risk is less than 10% in general. So resource allocation supports company strategy well in past and future. Also it is showed the company risk strategy is less in past in comparison with in future but the differences is not significant.

**Table 13.** SCA risk level ( past)- Company D

	CFI	BCFI	SCFI
MAPE	1.00	0.95	0.91

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>
<b>RMSE</b>	1.00	0.97	0.94
<b>MAD</b>	1.00	0.97	0.95

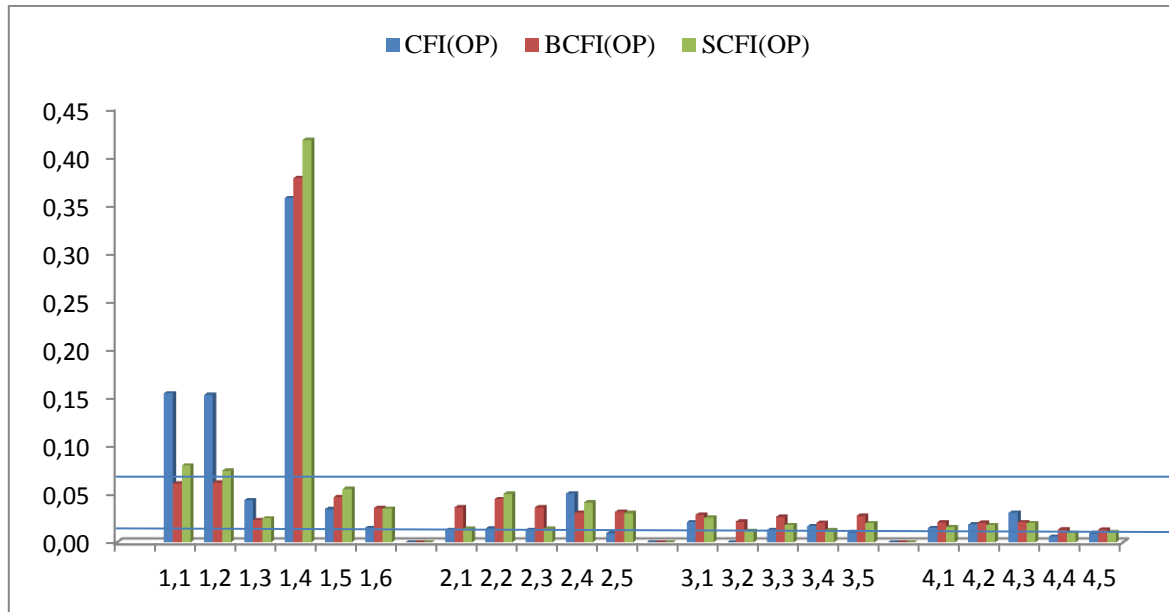
**Table 14.** SCA risk level (future) - Company D

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.95	0.91	0.95	0.90
<b>RMSE</b>	0.97	0.95	0.97	0.94
<b>MAD</b>	0.98	0.96	0.97	0.95

#### 4.5. Case Company E

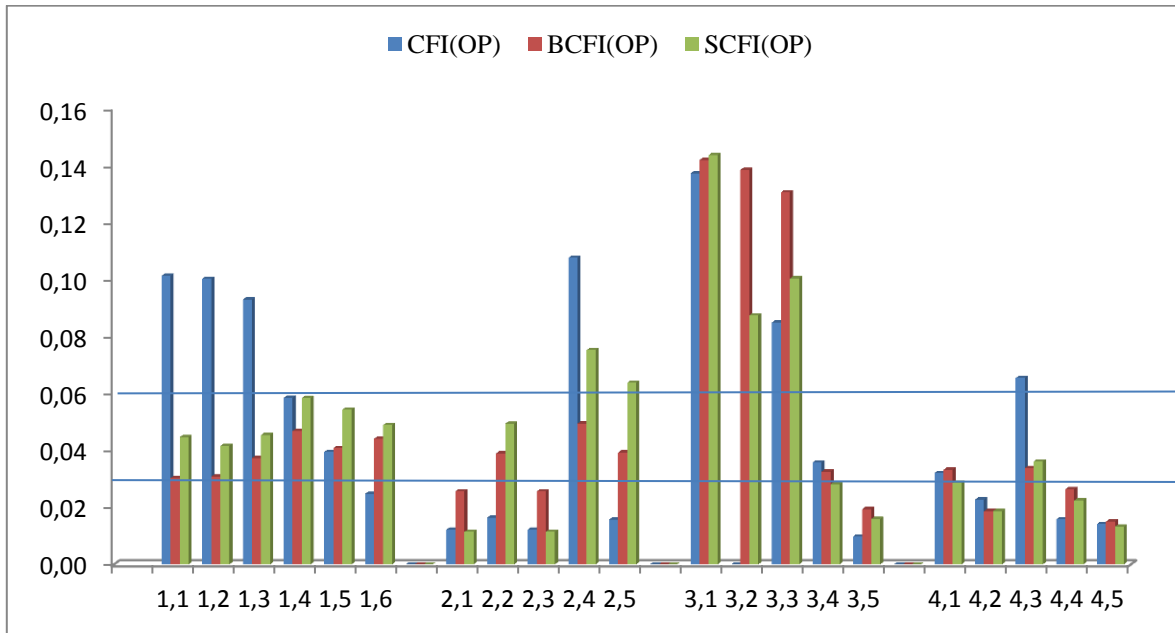
This company founded in 1979 and produces ice hockey equipment such as : ice hockey dasher board system, ice arena seats. This company is a leading manufacturer and provides ice hockey equipment for different world competitions. Besides, company E is known for superior products and on time delivery (source: company website).

Figure 38 and 39 demonstrate CFIs analysis for company D in past and in future. According to figure most of attributes are located in normal area and the most critical attribute is 1.4” Adaptation to knowledge and technology”



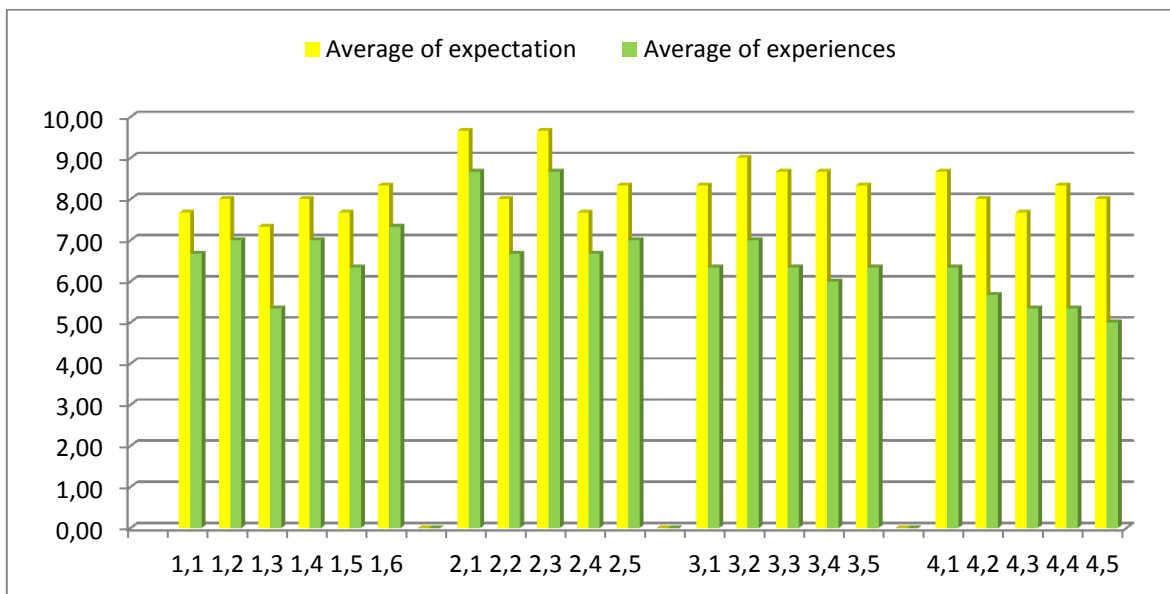
**Figure 38.** Presentation of extreme attributes for company E (past strategy)- CFIs analysis

Investigating figure 39 shows that in future there are more criteria in critical area but the most potential critical attribute are: 3.1” Leadership and management systems of the company”, 3.2” Quality control of products, processes and operations”, 3.3” Well defined responsibilities and tasks for each operation”.



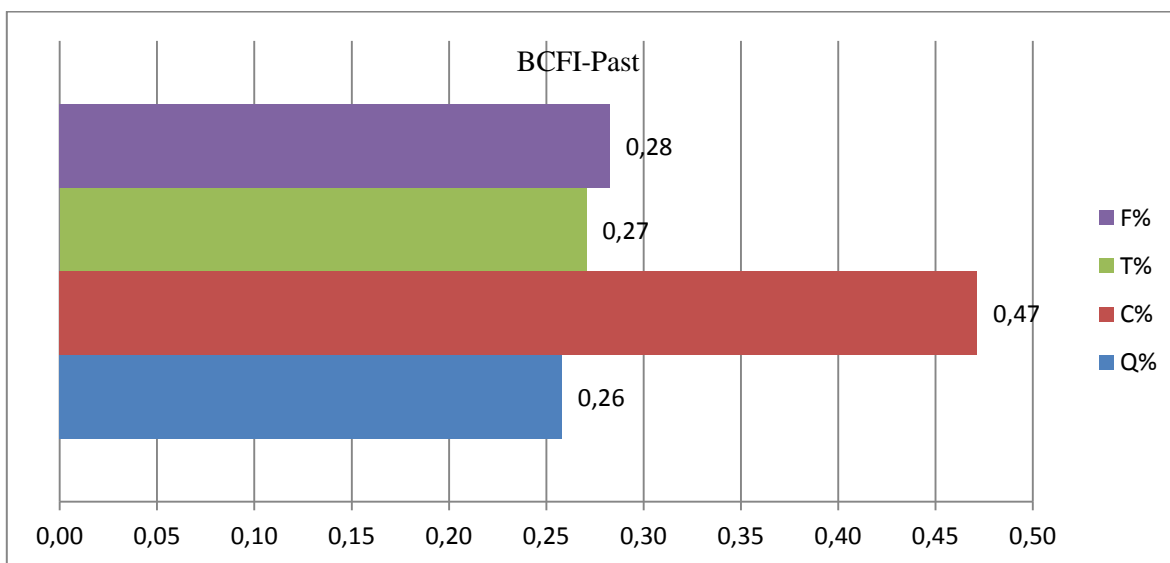
**Figure 39.** Presentation of extreme attributes for company E (Future strategy)- CFIs analysis

Figure 40 shows comparison between the level of experience in past and expectation in future in terms of different attributes. As the bar chart presents the average level of experiences and expectation for different attributes are 6 and 7 respectively. It shows company E plans to improve the level of resource for all attributes in future.

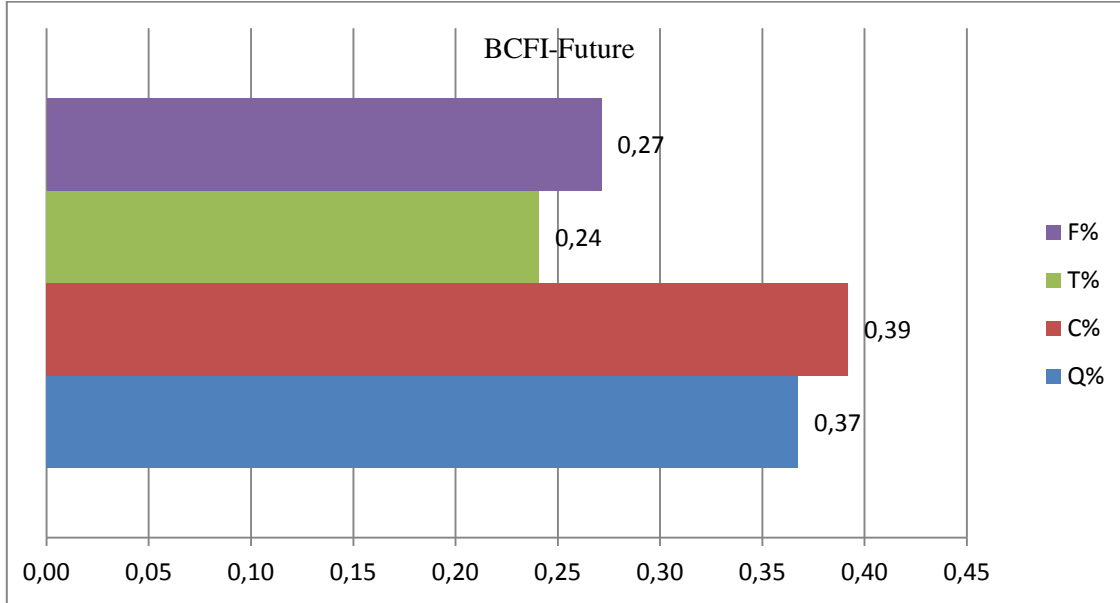


**Figure 40.** Comparison between expectations and experiences for company E

Figure 41 and 42 presents competitive priorities for company E in past and future.



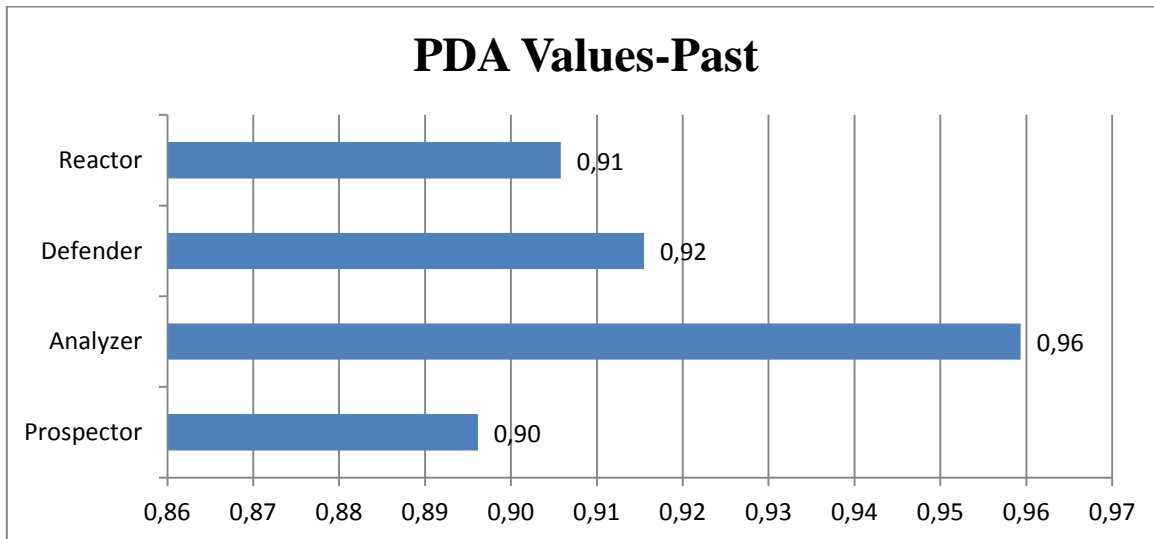
**Figure 41.** Competitive priorities in past- Company E



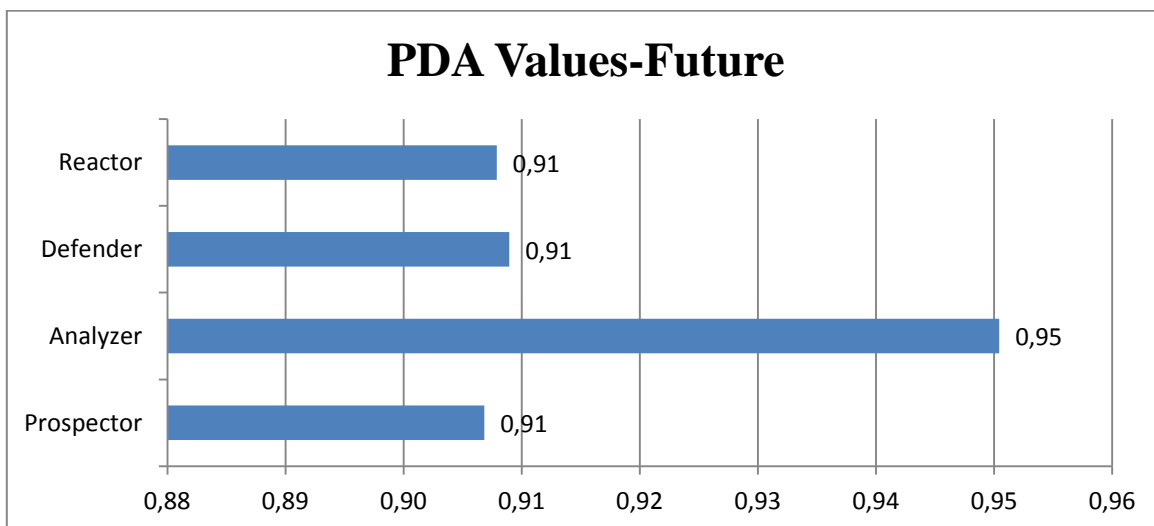
**Figure 42.** Competitive priorities in future- Company E

As two figures show the main competitive priority for company E in past and future is cost. However the competitive priorities are different in past and future. In past company strategy, the share of cost is 0,47 in company priorities and the share of flexibility, time and quality are 0,28, 0,27 and 0,26 respectively. So there is significant different between the level of cost and other competitive priorities. On the other hand, in future company strategy, the share of cost is 0,39 while the share of flexibility, time and quality are 0,27, 0,24 and 0,37 respectively. However the two figures show the first two main concentrations of company competitive priorities are time and quality.

Figures 43 and 44 shows PDA values for company E. As two figures show, the company strategy position is analyzer in past and future. Because there is no difference between companies' position in past and future, so the company strategy is sustainable. The position of analyzer for company E also suits to this situation that company E is famous for its high quality products and on time delivery.

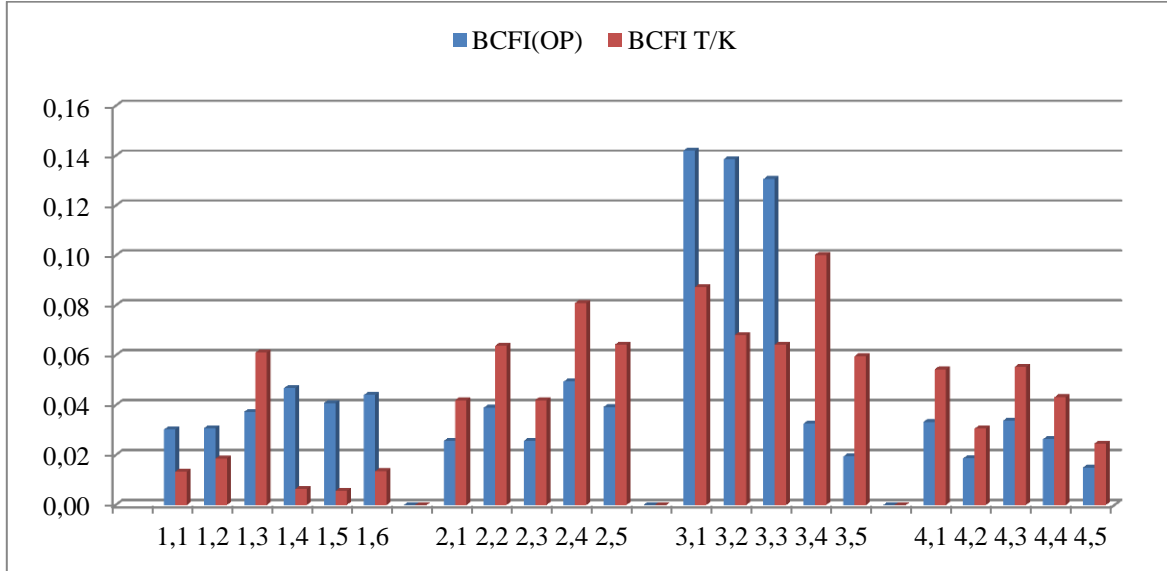


**Figure 43.** PDA values in past – Company E



**Figure 44.** PDA values in future– Company E

Figure 45 shows the effect of T/K factor on BCFI calculation.



**Figure45.** BCFI and BCFI T/K- Company E

and presents SCA risk level for company E in past and future respectively. Considering table 15 , the risk level of company strategy in past is around 10% which is less than company SCA risk level in future.

Investigating table 16 shows adding Technology and knowledge calculation to BCFI analysis increases the resource allocation risk level. However this amount of increases is not significant.

**Table 15.** SCA risk level ( past)- Company E

	CFI	BCFI	SCFI
<b>MAPE</b>	0.90	0.87	0.90
<b>RMSE</b>	0.94	0.92	0.94
<b>MAD</b>	0.95	0.93	0.95



**Table 16.** SCA Risk Level (future)- Company E

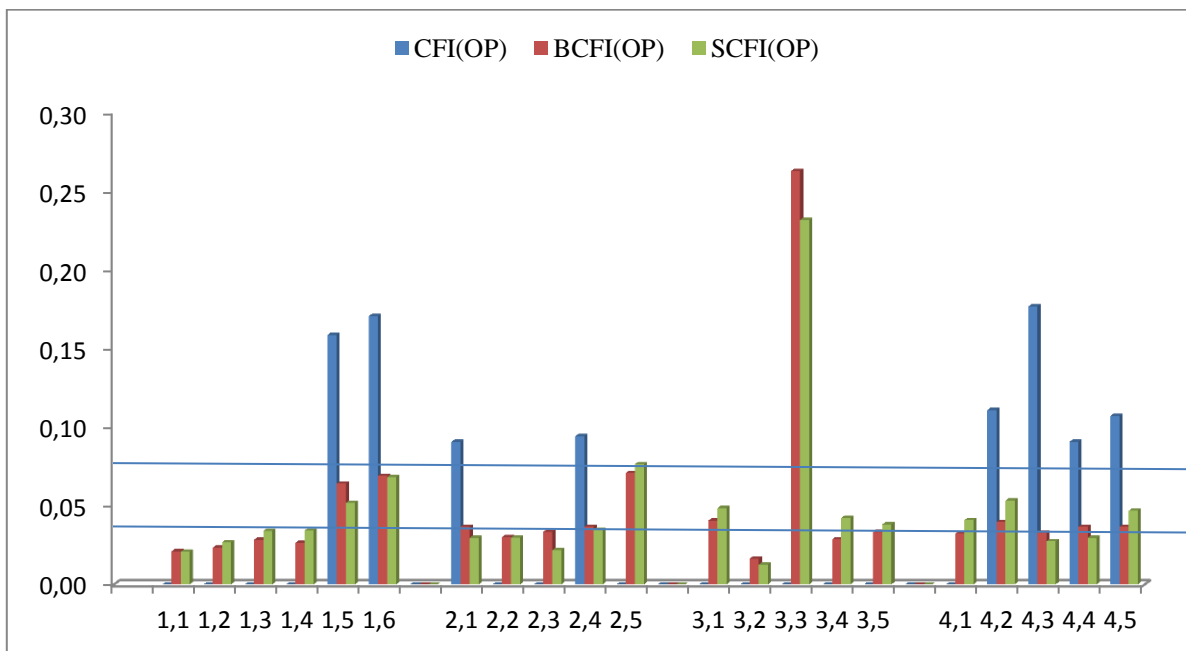
	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.88	0.88	0.84	0.83
<b>RMSE</b>	0.93	0.93	0.90	0.90
<b>MAD</b>	0.94	0.94	0.92	0.92

The analysis for WMT shows that SCA methods supports company E situation. In fact, the results are extremely good and findings of operation strategy and sustainable competitive advantages are fit to company real strategy.

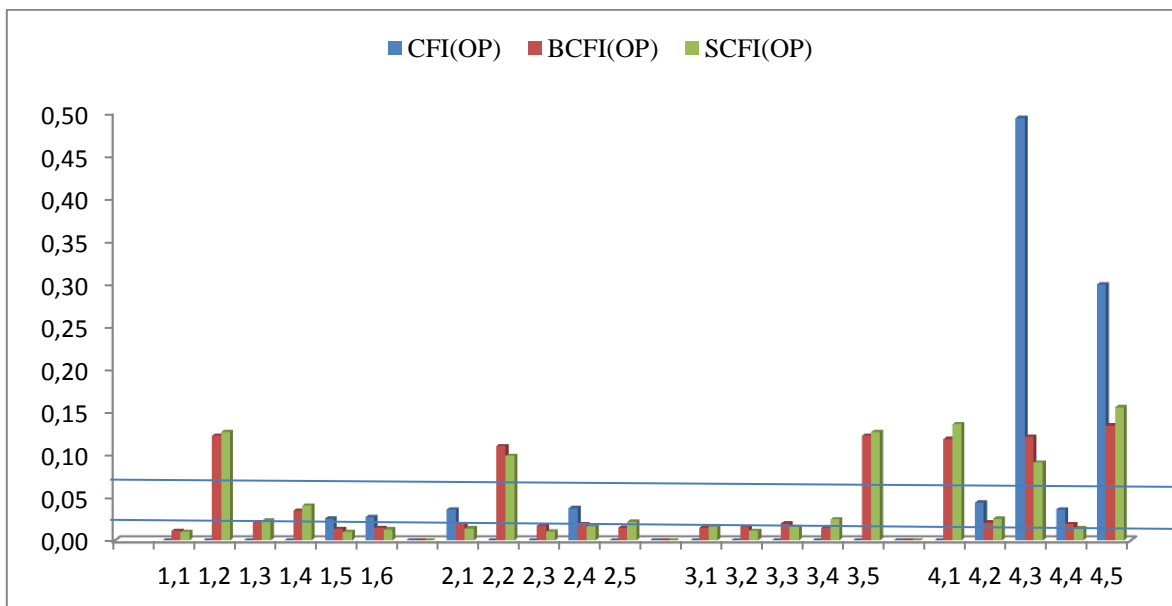
#### 4.6.Case Company F

This company produces mechanical wood product. The analysis of WMT represents that SCA method is applicable for this company and results meet reality and are acceptable.

Figure 46 and 47 present the extreme attributes for company F in past and in future respectively according to CFI, BCFI and SCFI method. In company F past analysis, the most critical attribute is 3.3, “Well defined responsibilities and tasks for each operation”. In future condition of company F, most of the criteria are located in critical area.

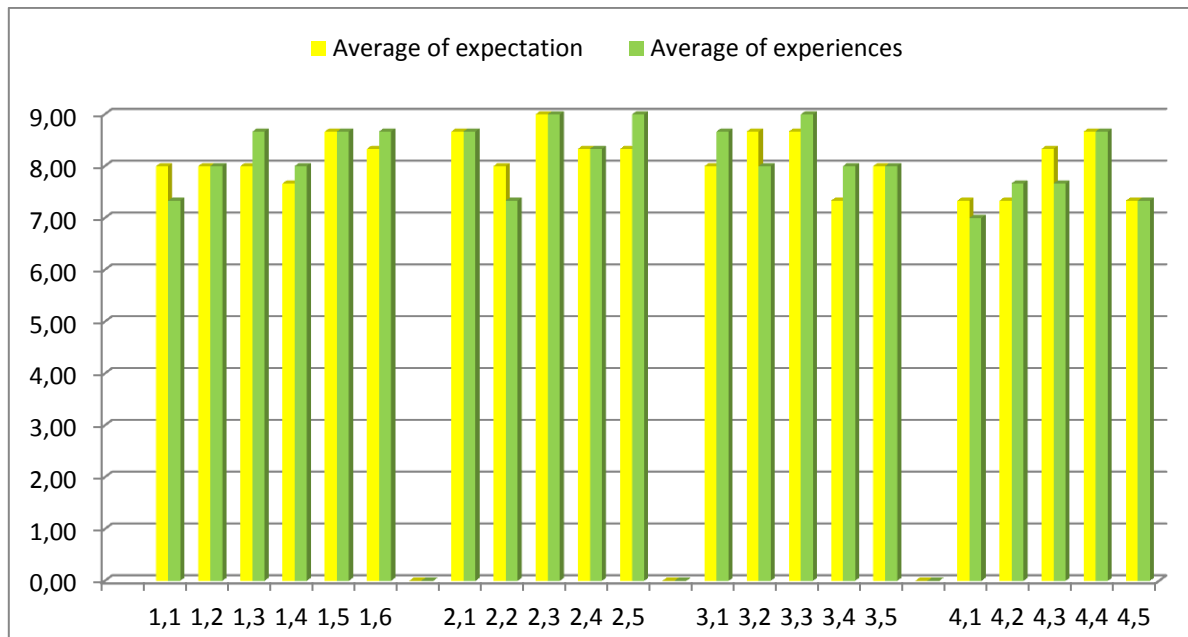


**Figure 46.** Presentation of extreme attributes for company F (past strategy)- CFIs analysis



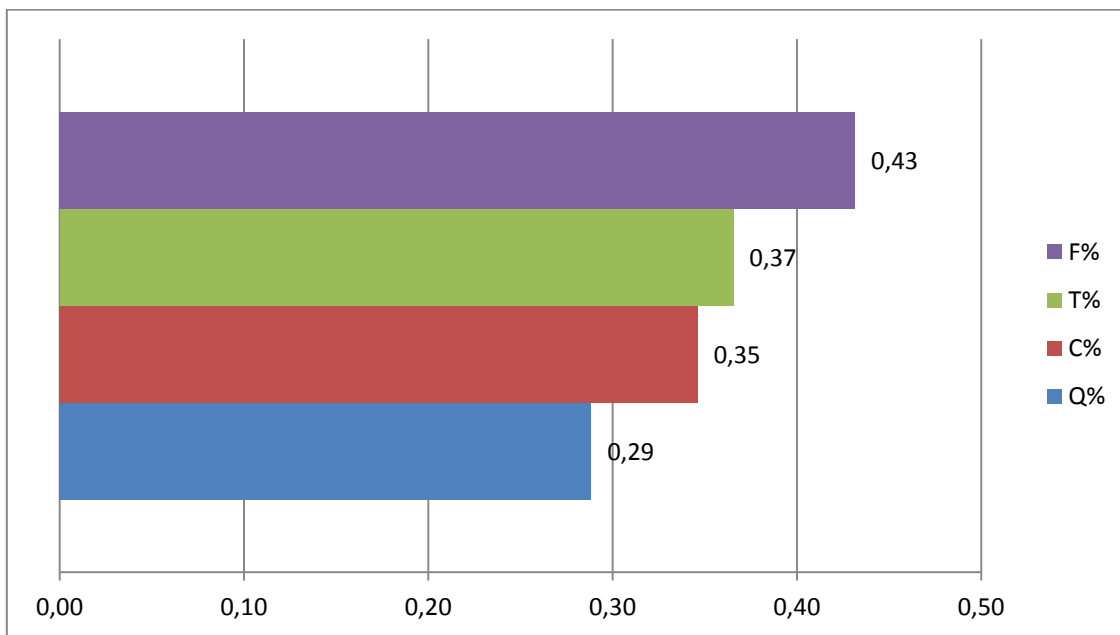
**Figure 47.** Presentation of extreme attributes for company E (Future strategy )- CFIs analysis

Figure 48 presents the level of resources of expectation and experience in past and future. As the bar chart shows, there is improvements in the level of resources for most attributes in future.

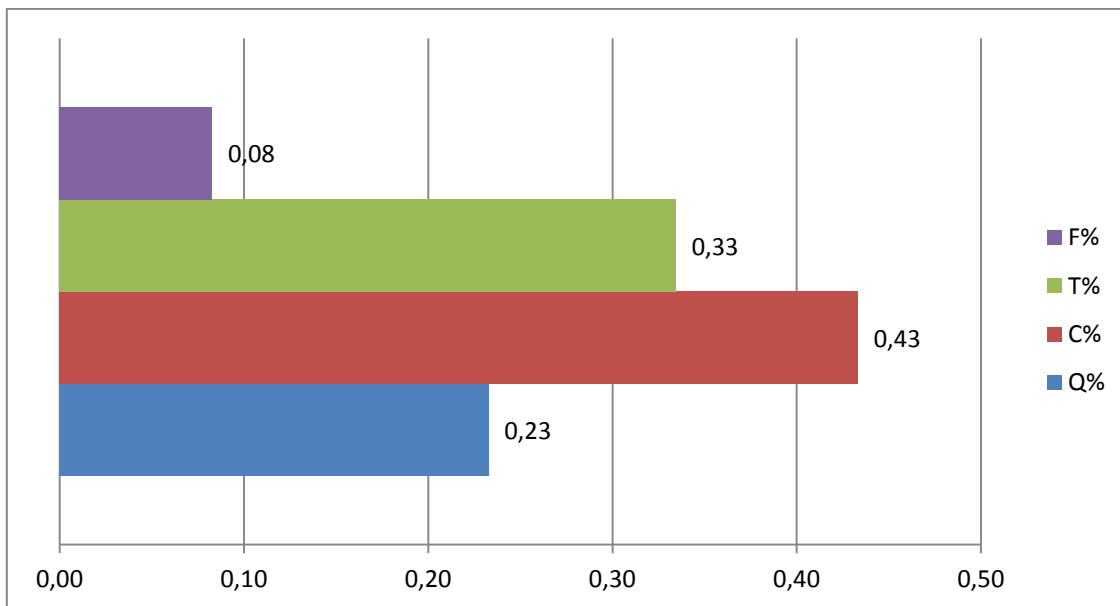


**Figure 48.** Comparison between expectations and experiences for company F

Bar charts 49 and 50 demonstrate competitive priorities for company F. In past strategy, the main concern of company F is flexibility and in future the main concern is cost.

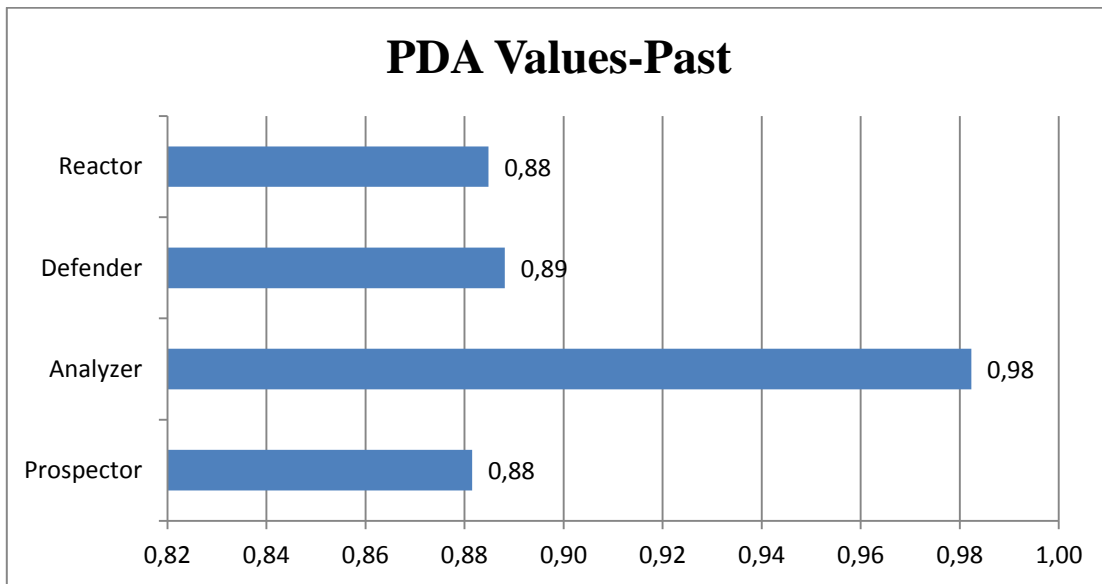


**Figure 49.** Competitive priorities in past- Company F

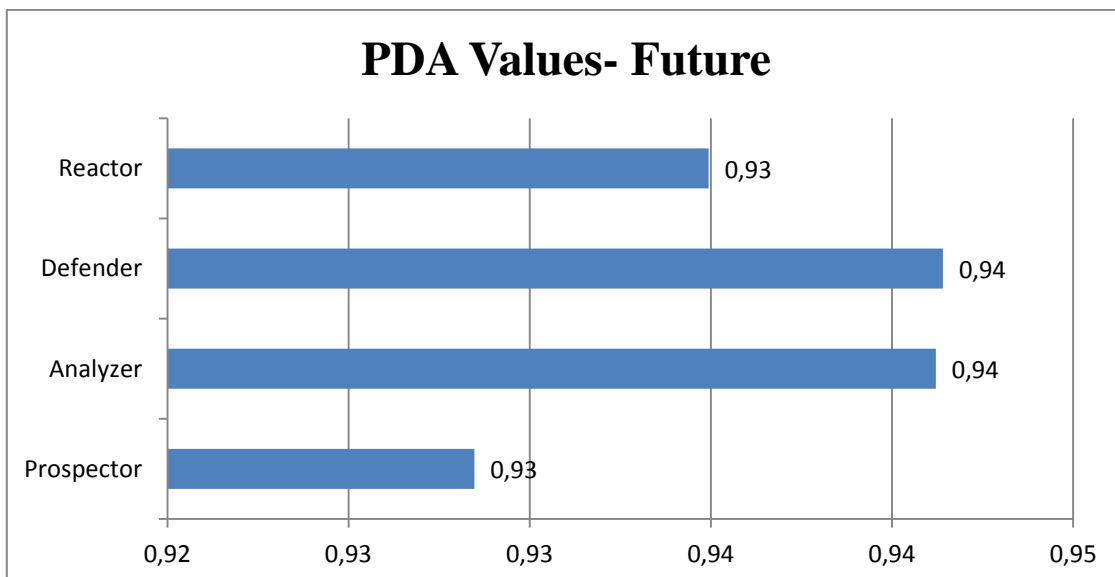


**Figure 50.** Competitive priorities in future- Company F

Figure 49 and 50 present the position of company F strategy. In past, the position of company F is analyzer while in future it can be analyzer and defender.

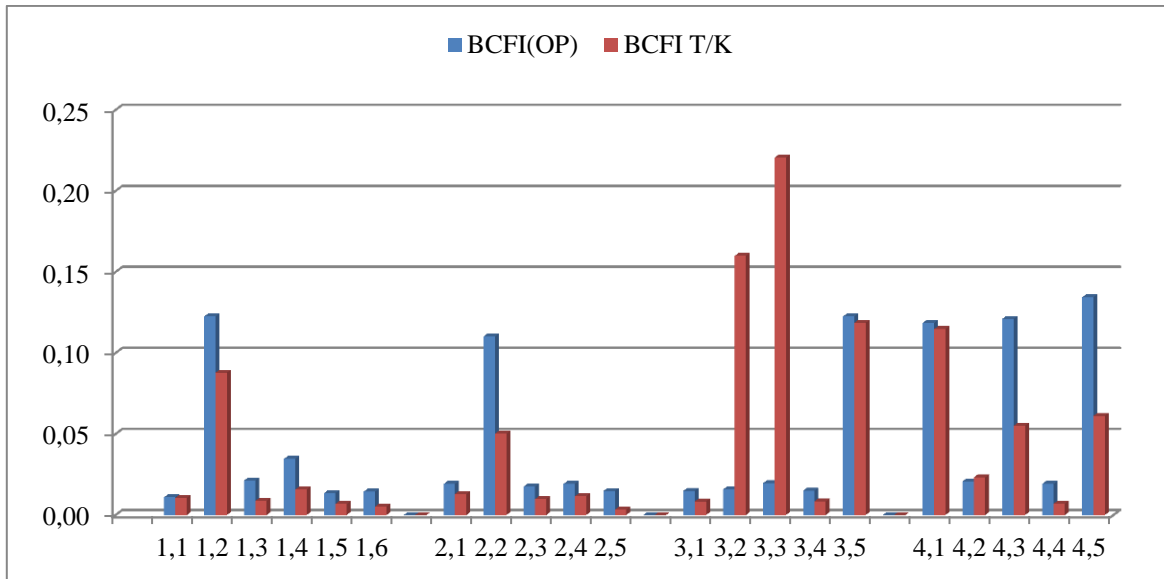


**Figure 51.** PDA values in past – Company F



**Figure 52.** PDA values in future – Company F

Figure 53 shows the level resources for different attributes according to BCFI and BCFI T/K. According to this bar chart, T/K factor effects on BCFI calculation but not to a fixed direction.



**Figure53.** BCFI and BCFI T/K- Company F

Table 17 and 18 presents company F risk level of resource allocation. According to table 17, SCA values is more than 0.90 considering different method hence, resource allocation in company F supports company strategy well in past. Comparison between risk level in past and future shows, company risk strategy increase in future and resource allocation supports company strategy less. Moreover, including T/K calculation increases the risk of resource allocation but it is not significant.

**Table 17.** SCA risk level ( past)- Company F

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>
<b>MAPE</b>	0.98	0.91	0.92
<b>RMSE</b>	0.99	0.94	0.95
<b>MAD</b>	0.99	0.95	0.96

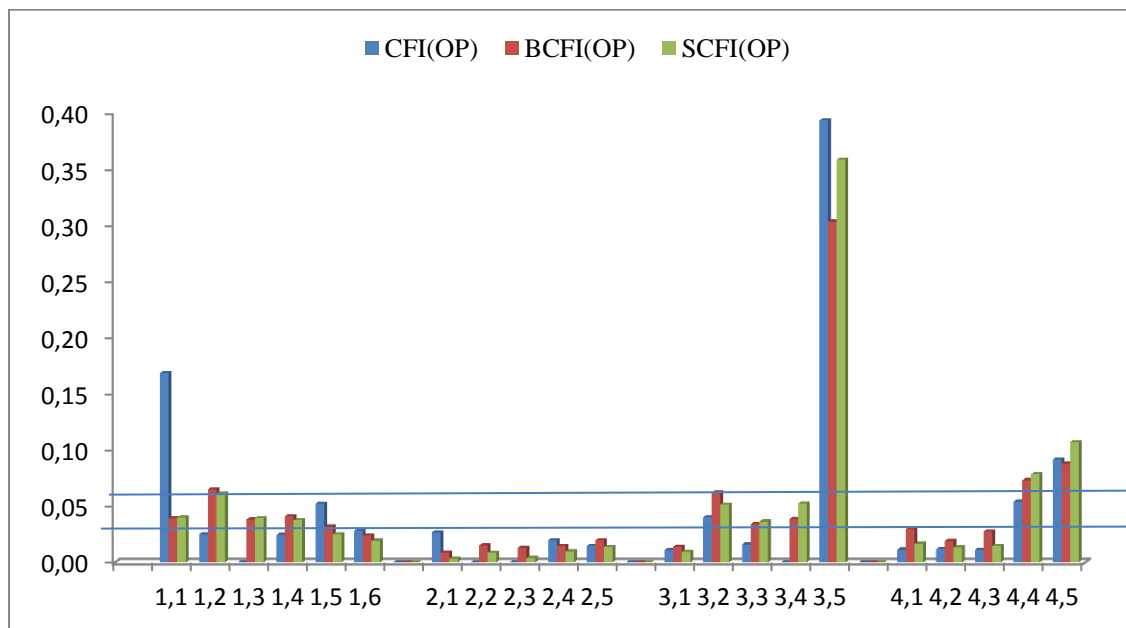
**Table 18.** SCA Risk Level ( future)- Company F

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.83	0.97	0.97	0.94
<b>RMSE</b>	0.90	0.98	0.98	0.96
<b>MAD</b>	0.91	0.98	0.99	0.97

#### 4.7.Case Company G

This company is established in 1987 and has experience on industrial automation solutions. The main market for this company is mechanical wood processing industry.

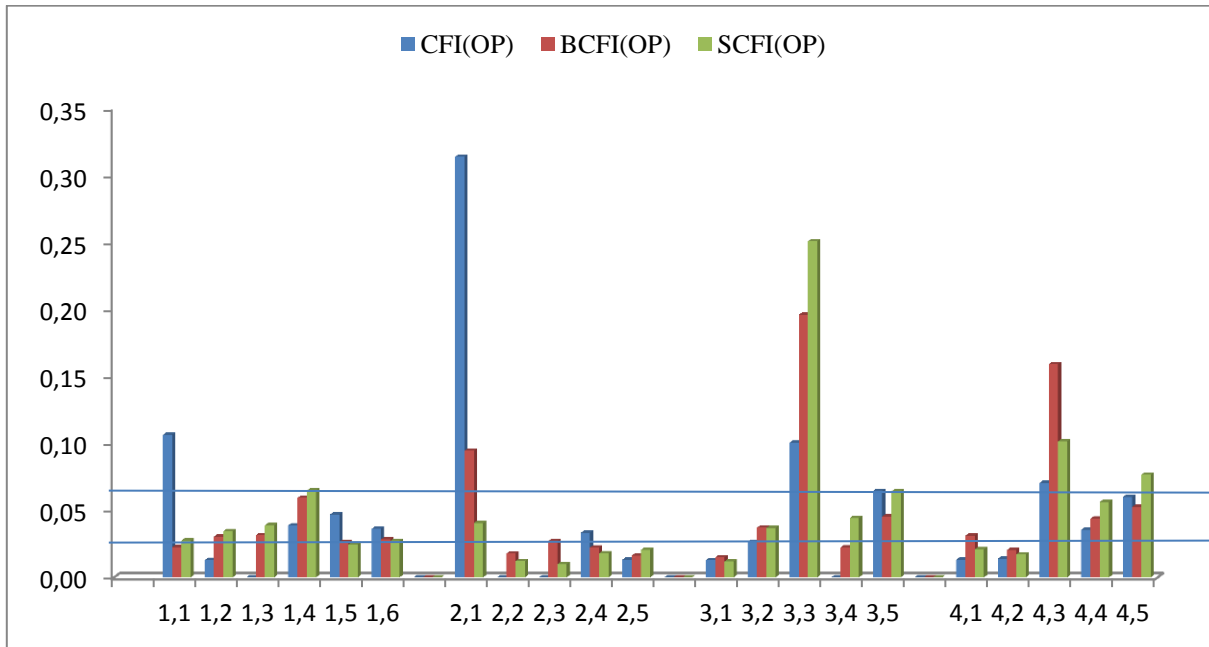
Bar charts 54 and 55 present the CFIs analysis for company G in past and future.



**Figure 54.** Presentation of extreme attributes for company G (past strategy)- CFIs analysis

According to figure 54 a lot of attributes are located in critical area. among critical attributes, criteria 2.1” Short and prompt lead-times in order-fulfillment process“, 2.2 “Reduction of unprofitable time in processes”, 2.3” Reduction of unprofitable time in processes”, 2.4” Control and optimization of all types of inventories”, 2.5” Adaptiveness of changes in demands and in order backlog”, 3.1” Leadership and management systems of the company” and 4.2 “Leadership and management systems of the company” are located in under resources area and attributes 3.5” Code of conduct and security of data and information”, 4.4” Quality & reliability of information in information systems” and 4.5 “Usability and functionality of information systems” are located in over resources area.





**Figure 55.** Presentation of extreme attributes for company G (future strategy ) - CFIs analysis

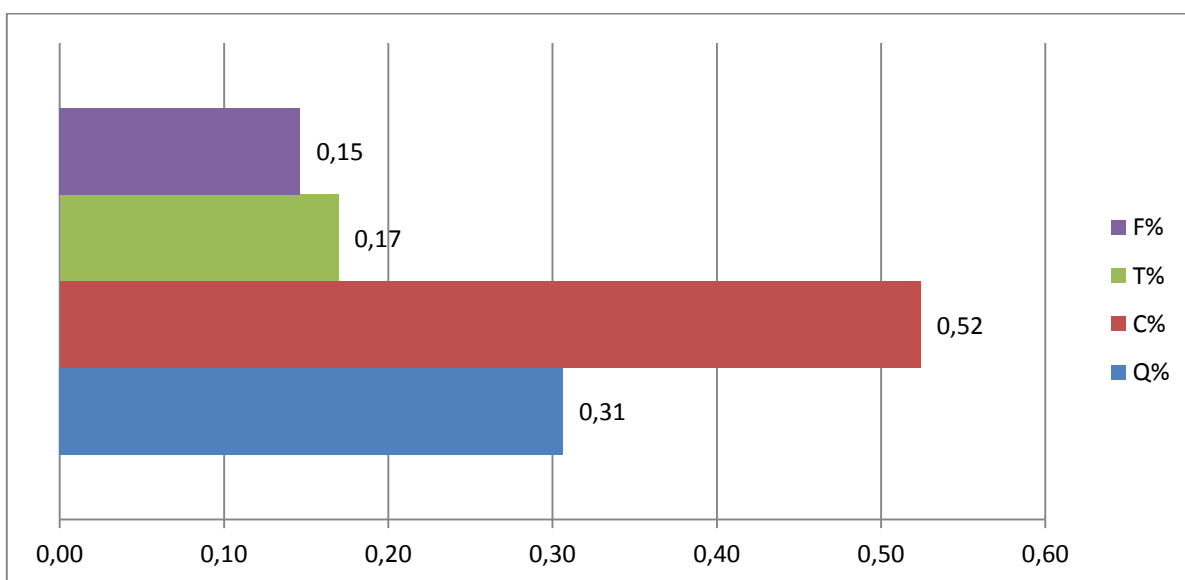
As figure 55 shows a lot of attributes are located in balanced line in future. the most potential critical attributes in future are: 2.1” Short and prompt lead-times in order-fulfillment process”, 3.3” Well defined responsibilities and tasks for each operation” and 4.3” Availability of information in information systems” which are located in over resources area.

Figure 56 demonstrates the experience and expectations of the level of different attribute in past and future. In general, there is enhancement in the level of most criteria in future. But for four attributes, the level of resources decrease in future. These attributes are: 3.4” Utilizing different types of organizing systems”, 3.5” Code of conduct and security of data and information”, 4.4” Quality & reliability of information in information systems” and 4.5” Usability and functionality of information systems”. Also for the criteria 1.2 ”Innovativeness and performance of research and development” the level of resources remains unchanged in future.



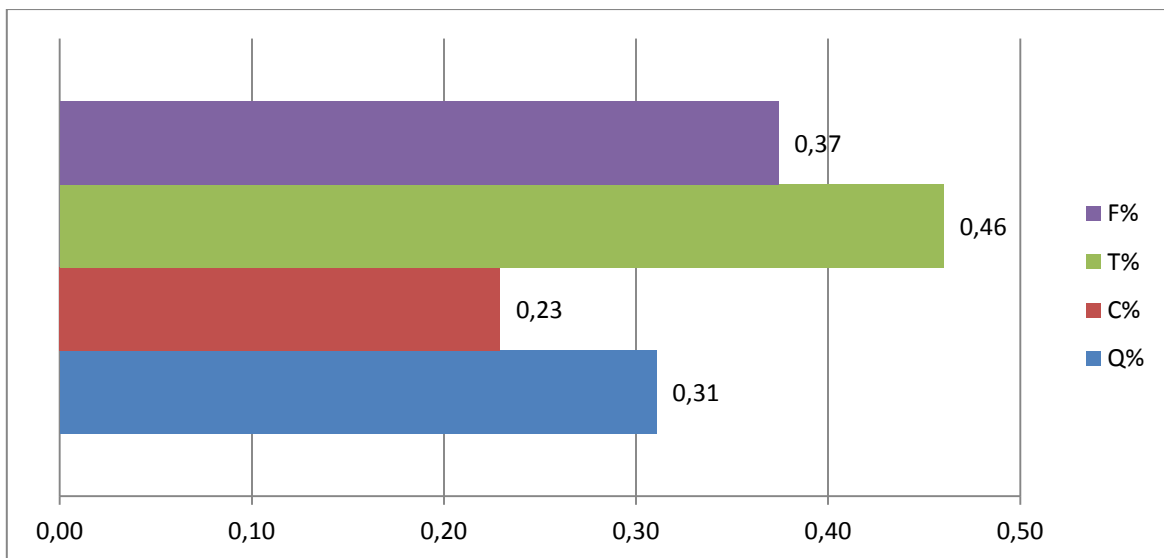
**Figure 56.** Comparison between expectations and. experiences for company G

Figure 57 presents the competitive advantages priorities for company G in past. According to this bar chart the main concern for company G is cost in past.



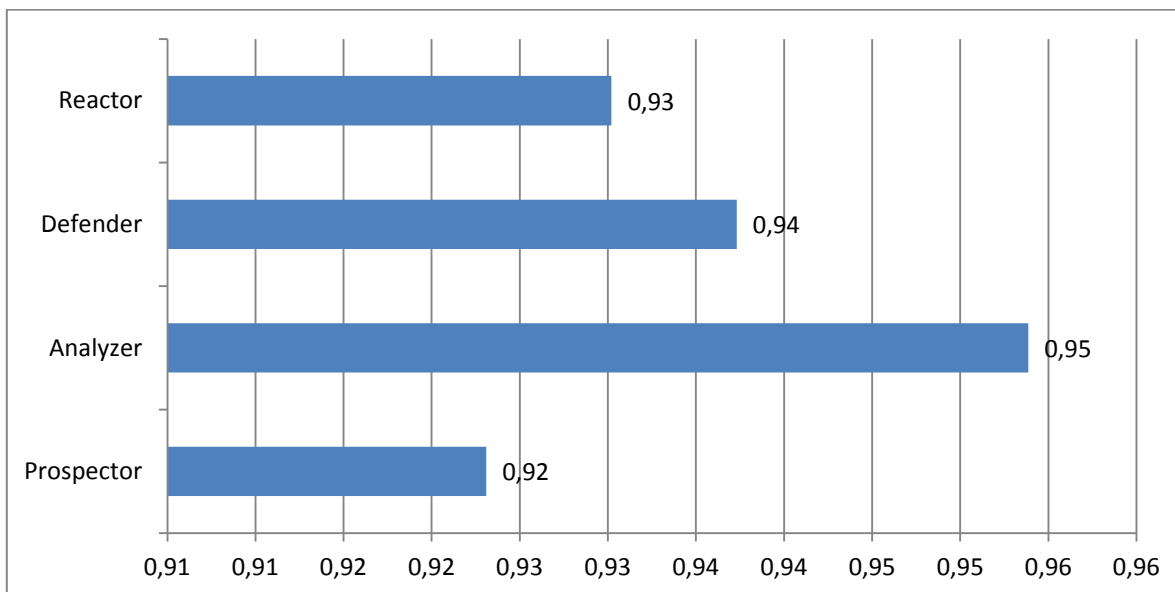
**Figure 57.** Competitive advantages in past- Company G

Figure 58 presents company G competitive priorities in future. According to this bar chart, the main concern for company G is time in future. The bar chart also shows that the Cost factor which was the most important focus in past, has the least concern in future among different competitive priorities.

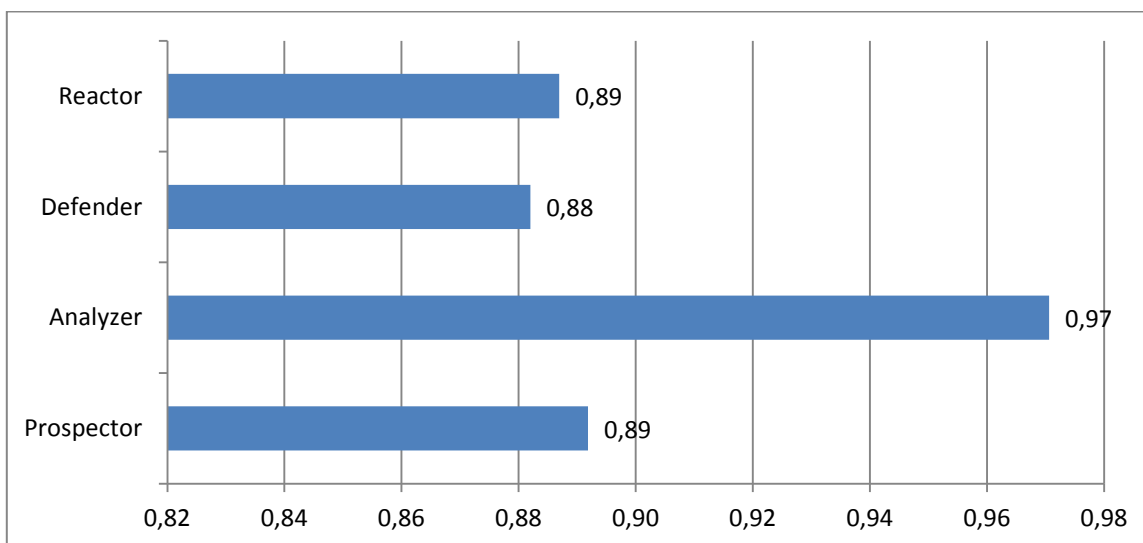


**Figure 58.** Competitive advantages in future- Company G

PDA values for company G in past and future are demonstrated in figure 59 and 60 respectively. PDA values for company G in past are: 0.95, 0.94, 0.93 and 0.92 for Analyzer, defender, reactor and prospector respectively. So the position of company G in past is mainly analyzer. PDA values for company G in future are: 0.97 for analyzer, 0.89 for reactor and prospector, 0.88 for reactor defender. Matches between two figures shows the position of company G remains unchanged in future. So company G strategy is sustainable.

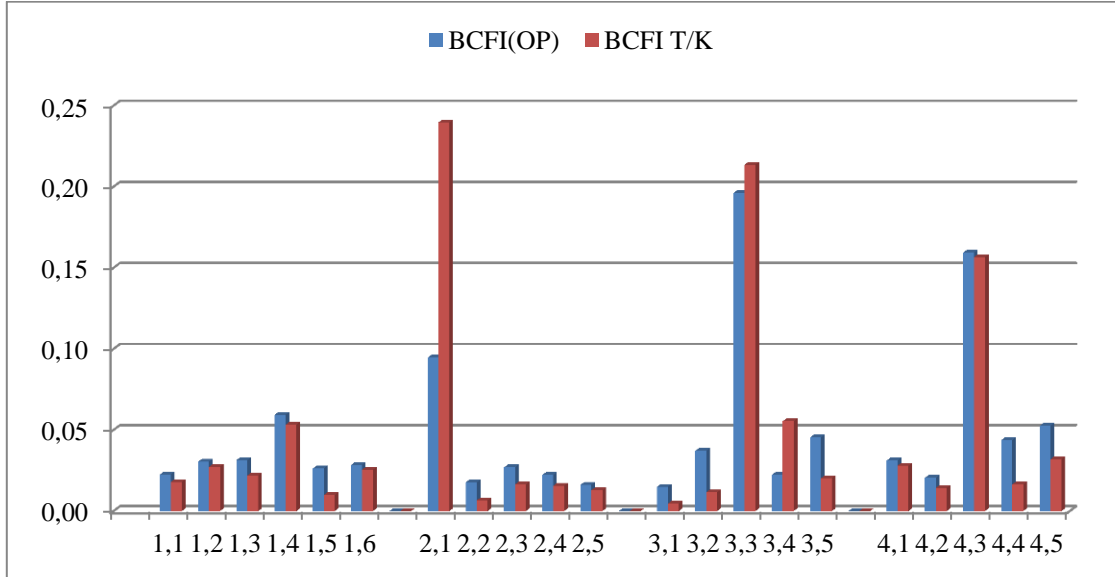


**Figure 59.** PDA values in past – Company G



**Figure 60.** PDA values in future – Company G

Figure 61 shows the effect of T/K calculation on BCFI factor.



**Figure61.** BCFI and BCFI T/K- Company G

SCA risk levels for company G strategy are demonstrated in following tables. Considering table 19 the risk level of company strategy is around 10% in past so company G resource allocation supports it's strategy well.

According to table 20, company G risk level is around 20% in future which is more than risk level in past. Another result from this table is that including T/K factor decreases the risk level but it is not significantly.

**Table19.** SCA risk level (past)- Company G

	CFI	BCFI	SCFI
<b>MAPE</b>	0.90	0.88	0.89
<b>RMSE</b>	0.94	0.92	0.92
<b>MAD</b>	0.95	0.94	0.94

**Table 20.** SCA risk level (future)- Company G

	<b>CFI</b>	<b>BCFI</b>	<b>SCFI</b>	<b>BCFI T/K</b>
<b>MAPE</b>	0.76	0.79	0.79	0.81
<b>RMSE</b>	0.85	0.87	0.87	0.88
<b>MAD</b>	0.89	0.90	0.90	0.91

In the last part of investigation company G, the results of WMT show that SCA method is applicable for this company and the results which are obtained with SCA method are as expected.

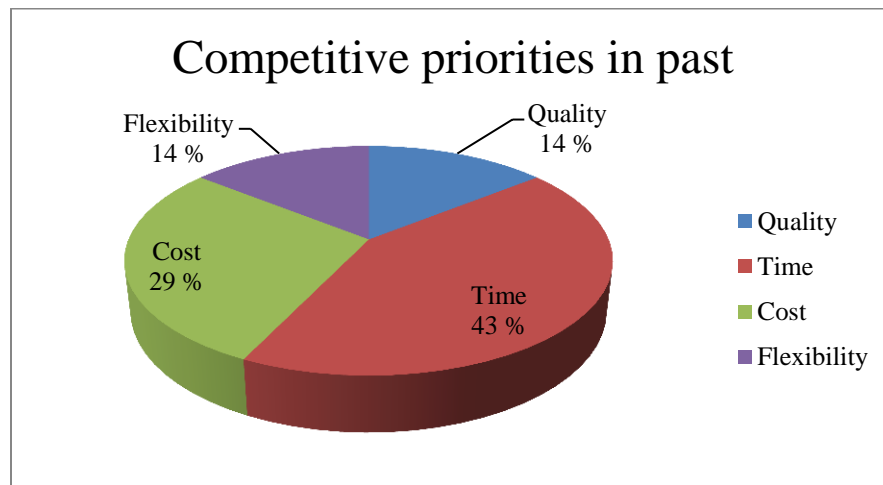
## 5. DISCUSSION

This paper investigates seven SME's companies in Finland in order to answer five questions:

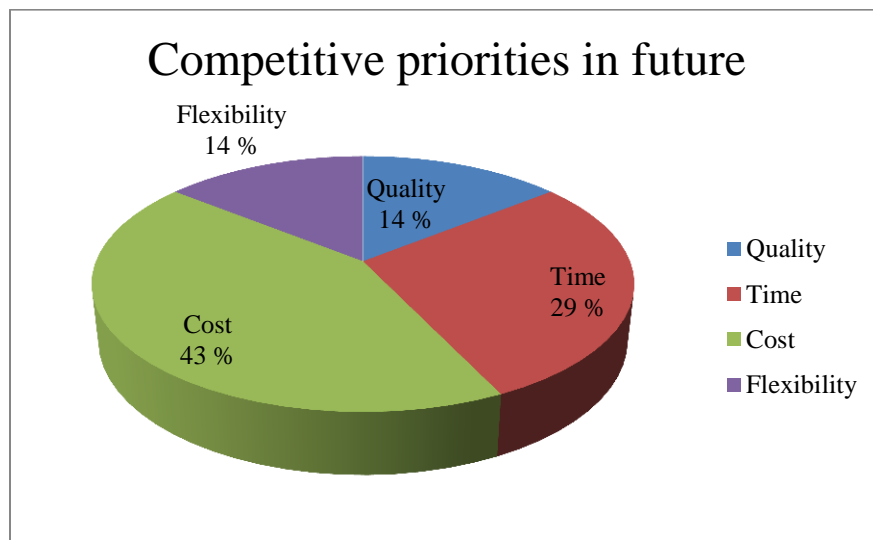
First question is related to the extent of application SCA method in SME's companies in Finland. The analysis of WMT is used to answer whether SCA results match the reality. According to investigation these case companies and the results of WMT, SCA is a good method to evaluate the sustainability of companies' strategy in OEI region. WMT analysis which are conducted for 5 cases out of 7 proves there is no significant difference between the SCA results and company real situation. In detail, WMT for company B shows there is no contradiction between SCA results and company current situation, for company C the results are as expected and very exact, for company E, SCA results is extremely fit to the operation strategy, for company F, SCA results is accepted and for company G, the results are accepted and guide company to the root of it's problem.

Second question seeks to find competitive priorities of SME's company in Finland. Investigation these seven cases shows the main competitive priorities for OEI companies are time and cost and these companies have less focus on quality and flexibility. In detail, competitive priorities for these case in past are: quality for company A, time for companies B ,C , D and cost for companies E and G and flexibility for company F. In future competitive priorities are: quality for company A, cost for companies B, E, F, time for companies C, G and fallibility for company D. the following two pie charts compare OEI companies' competitive advantages in past and in future. Studies of these seven cases show the SME's companies in Finland are mainly Analyzer. In detail, companies A, C, D,E, F and G take the position of Analyzer in past and future. company B is Analyzer in past and Defender in future. Finally, there are not any prospector or defender companies among these seven cases.

Third question tries to evaluate whether the strategy of SME's companies in OEI region are sustainable. Comparing the strategy position of companies in past and in future, it is concluded that there is not difference between company positions is past and in future for most of the cases which are studied. In detail, the strategy of companies A, C, D, E, F and G is sustainable. Only the position of company B changes from analyzer in past to defender in future. Hence, company B strategy is not sustainable.



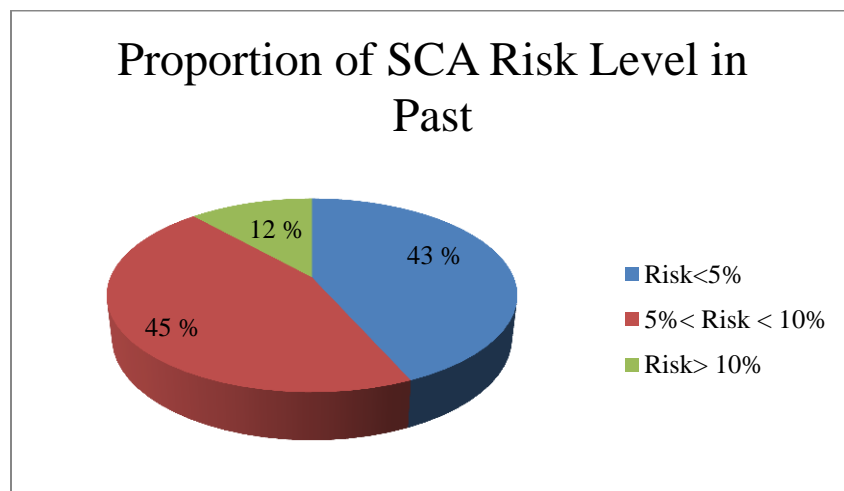
**Figure 62.** Competitive priorities in past



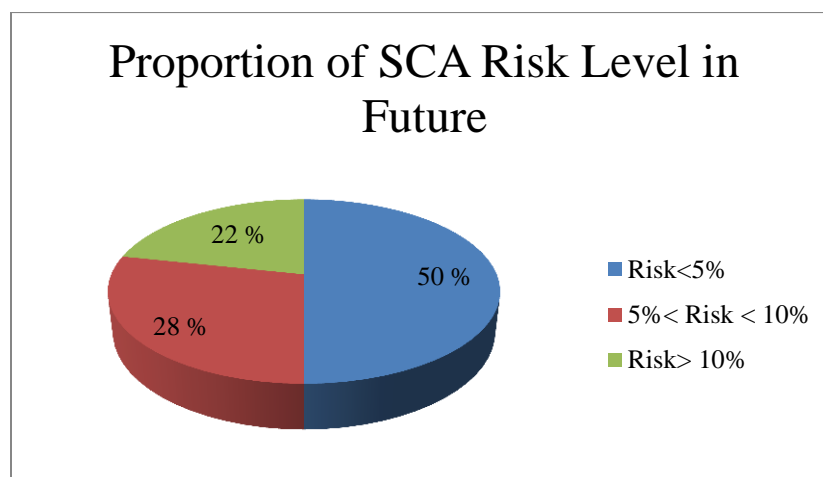
**Figure63.** Competitive priorities in future



Question number four focuses on SCA risk level and tries to answer to what extend companies internal resource allocation supports companies' strategy. In order to answer this question, 3 different levels of SCA are defined: risk less than 5%, more than 5% and less than 10% and more than 10%. Next step is to cluster all the result of MAPE, RMSE and MAD which are calculated regarding the results of CFI, BCFI and SCFI. Pie chart and represent the share of each cluster:



**Figure 64.** SCA risk classification in past



**Figure 65.** SCA risk classification in future

As the two pie charts show, almost 80% of SCA risk level is less than 10%. This results show in SME's company in Finland, resource allocation supports company strategy well.

Last question is to evaluate the effect of K/T factor on SCA values. Investigation of these cases shows that including K/T factor dose not guide SCA risk to fixed direction. In detail, including K/T calculation decrease the risk level in cases C and G. In case company E, SCA risk level remains unchanged including K/T factor. And for the rest, risk level increases after adding K/T factor.

## 6. CONCLUSION

This research concentrates on the importance of *Sustainable Competitive Advantages* which can help firm to be successful. Besides, this paper uses the Sense and Respond questionnaire to apply SCA method in real business world. The results which are obtained through CFIs analysis support companies to detect their strength and weakness. Finally, SCA level calculation prepares some tools to company that show to what extend company internal resource allocation supports company strategy.

This study attempts to answer five questions related *Small and Medium size* companies in Finland. The results show in general SCA method is applicable for these companies and reflect their real situation well. Moreover, this study shows SME's companies in Finland mainly have the position as analyzer and concentrate on time and cost factors. Besides, this study tries to evaluate the effect of K/T factor on CFIs analysis but it cannot make any final conclusions about this effect just provide an initial steps to further studies.

In summary, this research shows that the SCA studies are essential for companies as it provides priceless information for managers and enable them with a decision making tools which help them to understand business situation better and react more proper and more precise in turbulent business world.

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